CHAPTER 78

EXHAUST

LIST OF EFFECTIVE PAGES

N, R or D indicates pages which are New, Revised or Deleted respectively.

Remove and insert the affected pages and complete the Record of Revisions and the Record of Temporary Revisions as necessary.



CHAPTER 78

EXHAUST

LIST OF EFFECTIVE PAGES

N, R or D indicates pages which are New, Revised or Deleted respectively.

Remove and insert the affected pages and complete the Record of Revisions and the Record of Temporary Revisions as necessary.

CH/SE/SU	C	PAGE	DATE
S.B. LIST		1	May 30/79
S.B. LIST		2	May 30/79
S.B. LIST		3	May 30/80
S.B. LIST		4	Nov 30/81
S.B. LIST		5	Nov 30/81
S.B. LIST		6	Nov 30/81
S.B. LIST		7	Nov 30/81
S.B. LIST		8	Nov 30/81
S.B. LIST		9	Nov 30/81
S.B. LIST		10	Mar 31/99
S.B. LIST	R	11	May 31/03
S.B. LIST	R	12	May 31/03
S.B. LIST	R	13	May 31/03
S.B. LIST	R	14	May 31/03
T. of C.	R	1	May 31/03
T. of C.		2	Mar 31/00
T. of C.		3	Mar 31/00
T. of C.		4	Mar 28/02
T. of C.		5	Mar 31/00
T. of C.		6	Mar 28/02
T. of C.		7	Mar 31/00
78-00-00		1	Nov 30/75
78-00-00		2	Aug 30/76
78-00-00		3	Aug 30/78
78-00-00		401	Mar 29/96
78-00-00	R	402	May 31/03
78-00-00	R	403	May 31/03
78-00-00		404	Mar 29/96
78-00-00		405	Mar 31/95
78-00-00	R	406	May 31/03
78-00-00	R	407	May 31/03
78-00-00	R	408	May 31/03
78-00-00	R	409	May 31/03
78-00-00	N	410	May 31/03
78-00-00		501	Sep 30/90
78-00-00		502	Mar 31/99
78-00-00		503	Mar 31/99
78-00-00		504	Feb 28/81
78-00-00		505	Mar 31/99
78-00-00		506	Mar 31/99
78-00-00		506A	Mar 31/99
78-00-00		506B	Mar 31/99
78-00-00		507	Mar 31/99
78-00-00	R	508	May 31/03
78-00-00		509	Mar 31/99
78-00-00	R	510	May 31/03
78-00-00	R	510A	May 31/03
78-00-00	R	510B	May 31/03
78-00-00	N	510C	May 31/03
78-00-00	N	510D	May 31/03
78-00-00		511	Feb 28/81
78-00-00		512	Sep 30/90
78-00-00		513	Sep 30/90
78-00-00	R	514	May 31/03
78-00-00		515	Feb 28/81
78-00-00	R	516	May 31/03
78-00-00	R	517	May 31/03
78-00-00		518	Mar 31/00
78-00-00		519	Feb 28/81
78-00-00		520	Mar 31/99
78-00-00		521	Mar 31/99
78-00-00		522	Mar 31/99
78-00-00		522A	Mar 31/99
78-00-00		522B	Mar 31/99
78-00-00		523	Feb 28/81
78-00-00		524	Sep 30/90
78-00-00		525	Feb 28/81
78-00-00	R	526	May 31/03
78-00-00		527	Sep 30/90
78-10-00		1	Feb 28/78
78-10-00		2	May 30/80
78-10-00		3	Feb 28/78
78-10-00		4	May 30/80

CH/SE/SU	C	PAGE	DATE	CH/SE/SU	C	PAGE	DATE
78-10-00		5	Feb 28/79	78-12-01		605	Aug 30/77
78-10-00		6	Nov 30/75	78-12-01		606	Nov 30/75
78-10-00		7	Feb 28/79	78-12-01		607	May 30/80
78-10-00		8	Nov 30/75	78-12-01		608	Aug 30/78
78-10-00		9	Nov 30/75	78-12-01		609	Nov 30/75
				78-12-01		610	Nov 30/83
78-11-01		401	May 30/78	78-12-50		401	May 30/80
78-11-01		402	Aug 30/79	78-12-50		402	May 30/80
78-11-01		403	Aug 30/79	78-12-50		403	May 30/80
78-11-01		404	Aug 30/78	78-12-50		404	Aug 30/77
78-11-01		405	Nov 30/75	78-12-50		405	Aug 30/77
78-11-01		406	Nov 30/75	78-12-50		406	May 30/80
78-11-01		407	Nov 30/75	78-12-50		407	May 30/80
78-11-01		408	Aug 30/80	78-12-50		408	May 30/80
78-11-01		409	Aug 30/80	78-12-50		409	May 30/80
78-11-01		410	Aug 30/79	78-12-50		410	May 30/80
78-11-01		411	Aug 30/80	78-12-50		411	May 30/80
78-11-01		412	Nov 30/75	78-12-50		412	May 30/80
78-11-01		413	Aug 30/80	78-12-50		413	May 30/80
78-11-01		414	Aug 30/80	78-12-50		501	Sep 30/87
78-11-01		415	Aug 30/79	78-12-50		502	Sep 30/87
78-11-01		416	Aug 30/80	78-12-50		503	Sep 30/87
78-11-01		417	Aug 30/80	78-12-50		504	Sep 30/87
78-11-01		601	Aug 30/80	78-12-51		401	Feb 28/78
78-11-01		602	Aug 30/80	78-12-51		402	Aug 30/80
78-11-01		603	Aug 30/80	78-12-51		403	Aug 30/80
78-11-01		604	Aug 30/80	78-12-51		404	Feb 28/78
78-11-01		605	Aug 30/80	78-12-51		501	Feb 28/77
78-11-01		606	Aug 30/80				
78-11-01		607	Aug 30/80	78-13-01		401	Aug 30/79
78-11-01		608	Aug 30/80	78-13-01		402	Aug 30/79
				78-13-01		403	Aug 30/78
78-12-01		401	May 30/78	78-13-01		601	May 30/80
78-12-01		402	May 30/78	78-13-01		602	Feb 28/81
78-12-01		403	May 30/78	78-13-01		603	Mar 31/00
78-12-01		404	May 30/78	78-13-01		604	May 30/80
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78-12-01		406	May 30/78	78-13-01		606	May 30/80
78-12-01		407	May 30/78	78-13-01		607	May 30/80
78-12-01		408	May 30/78	78-13-01		608	May 30/80
78-12-01		409	Aug 30/79	78-13-01		609	May 30/80
78-12-01		410	Aug 30/79	78-13-01		610	Aug 30/80
78-12-01		411	Aug 30/79	78-13-01		611	May 30/80
78-12-01		412	Aug 30/79	78-13-01		612	May 30/80
78-12-01		413	Aug 30/79	78-13-01		613	May 30/80
78-12-01		414	Aug 30/79	78-13-01		614	May 30/80
78-12-01		601	May 30/77	78-13-01		615	Nov 30/80
78-12-01		602	Nov 30/83	78-13-01		616	Nov 30/80
78-12-01		603	Nov 30/83	78-13-01		617	Nov 30/80
78-12-01		604	Nov 30/75	78-13-01	R	618	May 31/03

CH/SE/SU	C	PAGE	DATE	CH/SE/SU	C	PAGE	DATE
78-13-01		619	Mar 31/00	78-30-00		6	Feb 28/77
78-13-01		620	Mar 31/00	78-30-00		7	Mar 31/00
78-13-01		621	Feb 28/81	78-30-00		8	Mar 31/00
78-13-01		622	May 30/82	78-30-00		9	Feb 28/77
78-13-01		623	May 30/82	78-30-00		10	Feb 28/77
78-13-01		624	May 30/82	78-30-00		11	May 30/77
78-13-01		625	Feb 28/81	78-30-00		12	Aug 30/78
78-13-01		626	Feb 28/81	78-30-00		13	Feb 28/77
78-13-01		627	Feb 28/81	78-30-00		14	Feb 28/77
78-13-01		628	Feb 28/81	78-30-00		15	Feb 28/77
78-13-01		629	Feb 28/81	78-30-00		16	Aug 30/78
78-13-01		630	Feb 28/81	78-30-00		17	Feb 28/77
78-13-01		631	Feb 28/81	78-30-00		18	Feb 28/77
78-13-01		632	Feb 28/81	78-30-00		19	Mar 31/00
78-13-01		633	Feb 28/81	78-30-00		20	Mar 31/00
78-13-01		634	Feb 28/81	78-30-00		21	Aug 30/78
78-13-01		635	Feb 28/81	78-30-00		22	Feb 28/77
78-13-01		636	Feb 28/81	78-30-00		23	Feb 28/77
78-13-01		637	Feb 28/81	78-30-00		24	Feb 28/77
78-13-01		801	May 30/78	78-30-00		25	Feb 28/77
78-13-01		802	May 30/78	78-30-00		26	May 30/77
78-13-01		803	Aug 30/78	78-30-00		27	Feb 28/77
78-13-01		804	Aug 30/76	78-30-00		28	Feb 28/77
78-13-01		805	May 30/78	78-30-00		29	Aug 30/78
78-13-01		806	May 30/78	78-30-00		30	Feb 28/77
78-13-11		401	Feb 29/80	78-30-00		31	Feb 28/77
78-13-11		402	Feb 29/80	78-30-00		32	Aug 30/77
78-13-11		403	Feb 29/80	78-30-00		33	May 30/77
78-13-11		404	Feb 29/80	78-30-00		34	Aug 30/78
78-13-11		405	Feb 29/80	78-30-00		35	May 30/79
78-13-11		406	Feb 29/80	78-30-00		36	May 30/79
78-13-11		407	Feb 29/80	78-30-00		401	Feb 28/81
78-13-11		408	Feb 29/80	78-30-00		402	Feb 28/81
78-13-11		409	Feb 29/80	78-30-00		403	May 30/78
78-13-12		401	Feb 29/80	78-30-00		404	Feb 28/81
78-13-12		402	May 30/80	78-30-00		405	Feb 28/81
78-13-12		403	Feb 29/80	78-30-00		406	Feb 28/81
78-13-12		404	Feb 29/80	78-30-00		407	Feb 28/81
78-13-12		405	Feb 29/80	78-30-00		408	Feb 28/81
78-13-12		406	Feb 29/80	78-30-00		409	Feb 28/81
78-13-12		407	May 30/80	78-30-00		410	Nov 30/82
78-13-12		408	Feb 29/80	78-30-00		411	Feb 28/81
78-13-12		409	Feb 29/80	78-30-00		412	Feb 28/81
78-13-12		410	Feb 29/80	78-30-00		501	Sep 30/92
				78-30-00		502	Feb 29/80
78-30-00		1	Mar 31/00	78-30-00		503	Feb 29/80
78-30-00		2	Mar 31/00	78-30-00		504	Feb 29/76
78-30-00		3	May 30/77	78-30-00		505	Feb 29/76
78-30-00		4	Feb 28/77	78-30-00		506	Feb 29/80
78-30-00		5	Feb 28/77	78-30-00		507	Feb 29/80

CH/SE/SU	C	PAGE	DATE	CH/SE/SU	C	PAGE	DATE
78-30-00		508	Feb 29/80	78-31-81		507	Aug 30/79
78-30-00		601	Nov 30/79	78-31-81		508	Aug 30/79
78-30-00		602	Aug 30/79	78-31-81		509	Aug 30/79
78-30-00		603	May 30/82	78-31-81		510	Nov 30/79
78-30-00		604	Aug 30/79	78-31-81		511	Aug 30/79
				78-31-81		512	Aug 30/79
78-31-01		401	Feb 29/80	78-31-81		513	Aug 30/79
78-31-01		402	Feb 29/80	78-31-81		801	Feb 28/79
78-31-01		403	Mar 27/97	78-31-81		802	Feb 28/79
78-31-01		404	May 30/79	78-31-81		803	Nov 30/78
78-31-01		405	Nov 30/79	78-31-81		804	Feb 28/79
78-31-01		406	May 30/79	78-31-81		805	Feb 28/79
78-31-01		407	Mar 31/99	78-31-81		806	Feb 28/79
78-31-01		408	Mar 31/99	78-31-81		807	Feb 28/79
78-31-01		409	Aug 30/79	78-31-82		501	May 30/79
78-31-01		410	Feb 29/80	78-31-82		502	May 30/79
78-31-01		411	Mar 31/99	78-31-82		503	May 30/79
78-31-01		412	Mar 31/99	78-31-82		504	May 30/79
78-31-01		413	Feb 29/80	78-31-82		505	May 30/79
78-31-01		414	Mar 31/99	78-31-83		401	Nov 30/79
78-31-01		601	Mar 31/00	78-31-83		402	Nov 30/79
78-31-01		602	Mar 31/00	78-31-83		403	Aug 30/77
78-31-01		603	Mar 31/00	78-31-83		501	Aug 30/77
78-31-01		604	Feb 29/76	78-31-84		401	Nov 30/78
78-31-01		605	Feb 29/76	78-31-84		402	Nov 30/78
78-31-11		401	Jun 30/75	78-31-84		403	Nov 30/78
78-31-11		402	Jun 30/75	78-31-84		501	Nov 30/77
78-31-11		403	Sep 29/89	78-31-84		502	Nov 30/79
78-31-12		401	Sep 30/90	78-31-84		503	May 30/81
78-31-12		402	Mar 28/02	78-31-84		504	Nov 30/77
78-31-12		403	Mar 28/02	78-31-84		505	Nov 30/77
78-31-12		404	Mar 28/02	78-31-84		506	Nov 30/77
78-31-12		405	Mar 28/02	78-31-84		507	Nov 30/77
78-31-12		501	Mar 28/02	78-31-84		508	Nov 30/77
78-31-12		502	Mar 28/02	78-31-84		509	Nov 30/77
78-31-12		503	Mar 28/02	78-31-84		510	Nov 30/77
78-31-12		504	Mar 28/02	78-31-84		511	Nov 30/77
78-31-81		401	Nov 30/80	78-31-84		512	Nov 30/77
78-31-81		402	Nov 30/80	78-31-84		513	Nov 30/77
78-31-81		403	Nov 30/80	78-31-84		514	Nov 30/77
78-31-81		404	Nov 30/82	78-31-84		515	Nov 30/77
78-31-81		405	Nov 30/80	78-31-84		516	Nov 30/77
78-31-81		406	Nov 30/80	78-31-84		517	Feb 28/78
78-31-81		407	Nov 30/80	78-31-84		518	Feb 28/78
78-31-81		501	Aug 30/79	78-31-84		519	Aug 30/78
78-31-81		502	Aug 30/79	78-31-84		520	Nov 30/77
78-31-81		503	Nov 30/79	78-31-84		521	Nov 30/77
78-31-81		504	Aug 30/79	78-31-84		522	Nov 30/77
78-31-81		505	Aug 30/79	78-31-84		523	Nov 30/77
78-31-81		506	Aug 30/79	78-31-84		524	Nov 30/77

CH/SE/SU	C	PAGE	DATE
78-31-84		525	Nov 30/77
78-31-85		401	Feb 28/81
78-31-85		402	Nov 30/82
78-31-85		403	Feb 28/81
78-31-85		501	Aug 30/76
78-32-19		301	Sep 30/87
78-32-19		302	Sep 30/87
78-32-19		303	Aug 30/81
78-32-19		304	Aug 30/81
78-32-19		305	Sep 30/87
78-32-19		306	Sep 30/87
78-32-19		307	Sep 30/87
78-32-19		308	Sep 30/87
78-32-19		401	Nov 30/79
78-32-19		402	Aug 30/79
78-32-19		403	Mar 27/97
78-32-19		404	Aug 30/79
78-32-19		405	Aug 30/79
78-32-19		406	Aug 30/79
78-32-19		407	Mar 27/97
78-32-19		408	Mar 27/97
78-33-06		401	Mar 28/02
78-33-06		402	Mar 28/02
78-33-06		403	Mar 28/02
78-33-06		404	Feb 28/81
78-33-06		405	Sep 30/86
78-33-06		406	Sep 30/86
78-33-06		407	Sep 30/86
78-33-06		408	Mar 28/02
78-33-06		409	Mar 28/02
78-33-06		410	Mar 28/02
78-33-06		411	Mar 28/02
78-33-06		412	Mar 28/02
78-33-06		413	Mar 28/02
78-33-06		414	Mar 28/02
78-33-06		501	Nov 30/79
78-33-06		502	Aug 30/79
78-33-06		503	Aug 30/79
78-33-06		504	Nov 30/78
78-33-06		505	Feb 28/77
78-33-06		506	Aug 30/79
78-33-06		507	Nov 30/79
78-33-06		508	Aug 30/79
78-33-06		509	Aug 30/79
78-33-06		510	Aug 30/79
78-34-01		301	Nov 30/79
78-34-01		302	Aug 30/79
78-34-01		303	May 30/78
78-34-01		304	Feb 28/77
78-34-01		305	Sep 30/90
78-34-01		306	Sep 30/90
78-34-01		401	May 30/78
78-34-01		402	Aug 30/79
78-34-01		403	Aug 30/80
78-34-01		404	Nov 30/76
78-34-01		405	Mar 27/97
78-34-01		406	Nov 30/76
78-34-01		407	Nov 30/76
78-34-01		408	Aug 30/78
78-34-01		409	May 30/78
78-34-01		410	Nov 30/76
78-34-01		411	May 30/76
78-34-01		412	Nov 30/76
78-34-01		413	May 30/78
78-34-01		414	Nov 30/76
78-34-01		415	Sep 30/90
78-35-01		401	Mar 27/97
78-35-01		402	Feb 28/81
78-35-01		403	Nov 30/82
78-35-01		404	Feb 28/81
78-35-01		405	Feb 28/81
78-35-01		406	Feb 28/81
78-35-00		407	Feb 28/81
78-35-01		408	Feb 28/81
78-35-01		601	Feb 29/76
78-35-01		602	Feb 29/76
78-36-01		501	Feb 28/81
78-36-01		502	Feb 28/81
78-36-01		503	Feb 28/81
78-36-01		504	Mar 31/95
78-36-01		505	Mar 31/95
78-36-01		506	Mar 31/95
78-37-01		1	Nov 30/75
78-37-01		2	Nov 30/75
78-37-01		3	Aug 30/78
78-37-01		4	Aug 30/78
78-37-01		5	Aug 30/78
78-37-01		401	Sep 30/90
78-37-01		402	Aug 30/79
78-37-01		403	Nov 30/77
78-37-01		404	Sep 30/90
78-37-01		405	Sep 30/90

SERVICE BULLETIN LIST

In the following service bulletin list, SB indicates an aircraft manufacturers bulletin, AEB indicates an airline engineering bulletin and OL indicates an engine manufacturers bulletin (complete identification OL.593-XX-XXX).

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
OL 78-001			Applicable Exhaust system -Primary nozzle -Nozzle petal actuating lever pins/Synchronisation yokes
OL 78-001	01		Applicable Exhaust system -Primary nozzle -Nozzle petal actuating lever pins/Synchronisation yokes
OL 78-001	02		Applicable Exhaust system -Primary nozzle -Nozzle petal actuating lever pins/Synchronisation yokes
OL 78-001	03		Applicable Exhaust system - Primary nozzle - Nozzle petal actuating lever pins/Synchronization yokes
OL 78-002			Applicable Exhaust system -Primary nozzle -Blanking cover, mounting pin housing -rework of,
OL 78-002	01		Applicable Exhaust system -Primary nozzle -Blanking cover, mounting pin housing -rework of,
OL 78-003			Applicable Exhaust system -Twin secondary nozzle -Ground test connector -Guide and lever
OL 78-003	01		Applicable Exhaust system -Twin secondary nozzle -Ground test connector -Guide and lever
OL 78-003	02		Applicable Exhaust system -Twin secondary nozzle -Ground test connector -Guide and lever
OL 78-004			Applicable Exhaust system -Reheat jet pipe -Brazing of bushings to the fuel drain tube
OL 78-004	01		Applicable Exhaust system -Reheat jet pipe -Brazing of bushings to the fuel drain tube
OL 78-004	02		Applicable Exhaust system -Reheat jet pipe -Brazing

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
			of bushings to the fuel drain tube
OL 78-004	03		Applicable Exhaust system -Reheat jet pipe -Brazing of bushings to the fuel drain tube
OL 78-004	04		Applicable Exhaust system -Reheat jet pipe -Brazing of bushings to the fuel drain tube
OL 78-004	05		Applicable Exhaust system - Reheat jet pipe - Brazing of bushings to the fuel drain tube
OL 78-005			Applicable Exhaust system -Reheat duct assy -Hoisting rings
OL 78-005	01		Applicable Exhaust system -Reheat duct assy -Hoisting rings
OL 78-005	02		Applicable Exhaust system -Reheat duct assy -Hoisting rings
OL 78-005	03		Applicable Exhaust system - Reheat duct assy - Hoisting rings
OL 78-006			Applicable Exhaust system -Primary nozzle =Primary nozzle area transducer -Angular pick-off driver in a single part
OL 78-006	01		Applicable Exhaust system -Primary nozzle -Primary nozzle area transducer -Angular pick-off driver in a single part
OL 78-006	02		Applicable Exhaust system -Primary nozzle -Primary nozzle area transducer -Angular pick-off driver in a single part
OL 78-006	03		Applicable Exhaust system -Primary nozzle -Primary nozzle area transducer -Angular pick-off driver in a single part
OL 78-007			Applicable Exhaust system -Primary nozzle -Area transducer -Linkage system adjunction of a second actuated petal
OL 78-007	01		Applicable Exhaust system -Primary nozzle -Area

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SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
			transducer -Linkage system adjunction of a second actuated petal
OL 78-007	02		Applicable Exhaust system -Primary nozzle -Area transducer -Linkage system adjunction of a second actuated petal
OL 78-008			Applicable Exhaust system -Primary nozzle -Reinforcement of convergent
OL 78-008	01		Applicable Exhaust system -Primary nozzle -Reinforcement of convergent
OL 78-008	02		Applicable Exhaust system -Primary nozzle -Reinforcement of convergent
OL 78-008	03		Applicable Exhaust system -Primary nozzle -Reinforcement of convergent
OL 78-009			Applicable Exhaust system -Twin secondary nozzle -Rear frame buckets/Heat shield seals
OL 78-009	01		Applicable Exhaust system -Twin secondary nozzle -Rear frame buckets/Heat shield seals
OL 78-010			Applicable Exhaust system -Twin secondary nozzle -Renewal of access doors attachment bolts
OL 78-010	01		Applicable Exhaust system -Twin secondary nozzle -Renewal of access doors attachment bolts
OL 78-011			Applicable Exhaust system -Twin secondary nozzle -Access doors -Modification of
OL 78-011	01		Applicable Exhaust system -Twin secondary nozzle -Access doors -Modification of
OL 78-011	02		Applicable Exhaust system -Twin secondary nozzle -Access doors -Modification of
OL 78-011	03		Applicable Exhaust system - Twin secondary nozzle - Access doors - Modification of
OL 78-012			Applicable Exhaust -Thrust reverser actuation system

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
			Improvement in safety of
OL 78-012	01		Applicable
			Exhaust -Thrust reverser actuation system Improvement in safety of
OL 78-012	02		Applicable
			Exhaust -Thrust reverser actuation system Improvement in safety of
OL 78-012	03		Applicable
			Exhaust -Thrust reverser actuation system Improvement in safety of
OL 78-012	04		Applicable
			Exhaust - Thrust reverser actuation system Improvement in safety of
OL 78-013			Applicable
			Exhaust -Thrust reverser actuation system Improvement in safety of
OL 78-013	01		Applicable
			Exhaust - Thrust reverser actuation system Improvement in safety of
OL 78-014			Applicable
			Exhaust system -Twin secondary nozzle electrical harnesses -New routing of
OL 78-014	01		Applicable
			Exhaust system -Twin secondary nozzle electrical harnesses -New routing of
OL 78-015			Applicable
			Exhaust system -Primary nozzle -Change in material of the primary nozzle area transducer pins
OL 78-015	01		Applicable
			Exhaust system -Primary nozzle -Change in material of the primary nozzle area transducer pins
OL 78-015	02		Applicable
			Exhaust system -Primary nozzle -Change in material of the primary nozzle area transducer pins
OL 78-016			Applicable
			Exhaust system - Twin secondary nozzle - Improvement in the removal of access doors to Garrett accessories
OL 78-016	01		Applicable
			Exhaust system - Twin secondary nozzle - Improvement in the removal of access doors

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
			to Garrett accessories
OL 78-016	02		Applicable Exhaust system - Twin secondary nozzle - Improvement in the removal of access doors to Garrett accessories
OL 78-016	03		Applicable Exhaust system - Twin secondary nozzle - Improvement in the removal of access doors to Garrett accessories
OL 78-017			Applicable Exhaust system -Twin secondary nozzle - Buckets -Reinforcement of
OL 78-017	01		Applicable Exhaust system -Twin secondary nozzle - Buckets -Reinforcement of
OL 78-017	02		Applicable Exhaust system -Twin secondary nozzle - Buckets -Reinforcement of
OL 78-017	03		Applicable Exhaust system -Twin secondary nozzle - Buckets -Reinforcement of
OL 78-017	04		Applicable Exhaust system -Twin secondary nozzle - Buckets -Reinforcement of
OL 78-018			Applicable Exhaust system -Twin secondary nozzle - Primary nozzle area transducer cable protection
OL 78-018	01		Applicable Exhaust system -Twin secondary nozzle - Primary nozzle area transducer cable protection
OL 78-018	02		Applicable Exhaust system -Twin secondary nozzle - Primary nozzle area transducer cable protection
OL 78-018	03		Applicable Exhaust system -Twin secondary nozzle - Primary nozzle area transducer cable protection
OL 78-018	04		Applicable Exhaust system -Twin secondary nozzle - Primary nozzle area transducer cable protection

SERVICE BULLETIN LIST

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
OL 78-019			Applicable Exhaust system -Twin secondary nozzle - Bucket ballscrew gearbox flexible shafts - Protection of
OL 78-019	01		Applicable Exhaust system -Twin secondary nozzle - Bucket ballscrew gearbox flexible shafts - Protection of
OL 78-019	02		Applicable Exhaust system -Twin secondary nozzle - Bucket ballscrew gearbox flexible shafts - Protection of
OL 78-020			Applicable Exhaust system -Twin secondary nozzle - Protection of side walls
OL 78-020	01		Applicable Exhaust system -Twin secondary nozzle - Protection of side walls
OL 78-020	02		Applicable Exhaust system -Twin secondary nozzle - Protection of side walls
OL 78-020	03		Applicable Exhaust system -Twin secondary nozzle - Protection of side walls
OL 78-021			Applicable Exhaust system -Twin secondary nozzle - Bucket ballscrew gearbox flexible shafts - Protection of
OL 78-021	01		Applicable Exhaust system -Twin secondary nozzle - Bucket ballscrew gearbox flexible shafts - Protection of
OL 78-022			Applicable Exhaust system -Twin secondary nozzle - Access doors to the bucket position trans- mitters (indicators) -Retrofitting of
OL 78-022	01		Applicable Exhaust system -Twin secondary nozzle - Access doors to the bucket position trans- mitters (indicators) -Retrofitting of
OL 78-022	02		Applicable Exhaust system -Twin secondary nozzle - Access doors to the bucket position trans- mitters (indicators) -Retrofitting of

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
OL 78-022	03		Applicable Exhaust system - Twin secondary nozzle - Access doors to the bucket position transmitters (indicators) - Retrofitting of
OL 78-022	04		Applicable Exhaust system - Twin secondary nozzle - Access doors to the bucket position transmitters (indicators) - Retrofitting of
OL 78-023			Applicable Exhaust system -Twin secondary nozzle - Bucket crossfeed isolation valve -Modification of
OL 78-024		Nov 30/77	Embodied Exhaust system -Twin secondary nozzle - Modification of bucket ballscrew gearboxes
OL 78-025			Applicable Exhaust system - Reheat jet pipe - Ventilation shroud - Reinforcement of
OL 78-025	01		Applicable Exhaust system - Reheat jet pipe - Ventilation shroud - Reinforcement of
OL 78-025	02		Applicable Exhaust system - Reheat jet pipe - Ventilation shroud - Reinforcement of
OL 78-025	03		Applicable Exhaust system - Reheat jet pipe - Ventilation shroud - Reinforcement of
OL 78-026			Applicable Exhaust system - Twin secondary nozzle - Attachment of the bucket deflectors - Improvement of
OL 78-026	01		Applicable Exhaust system - Twin secondary nozzle - Attachment of the bucket deflectors - Improvement of
OL 78-026	02		Applicable Exhaust system - Twin secondary nozzle - Attachment of the bucket deflectors - Improvement of
OL 78-027			Applicable Exhaust - Thrust reverser system - Nozzle and thrust reverser controller assembly
OL 78-027	01		Applicable

SERVICE BULLETIN LIST

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
			Exhaust - Thrust reverser system - Nozzle and thrust reverser controller assembly
OL 78-028	+		Not applicable
OL 78-029			Applicable
			Exhaust system -Twin secondary nozzle - Addition of a Film of Elastomere on the access cover plates to the bucket ball-screw gearboxes attachment bolts
OL 78-029	01		Applicable
			Exhaust system -Twin secondary nozzle - Addition of a Film of Elastomere on the access cover plates to the bucket ball-screw gearboxes attachment bolts
OL 78-030			Applicable
			Exhaust system -Twin secondary nozzle - Modification of bucket pneumatic drive actuator
OL 78-031			Applicable
			Exhaust system -Twin secondary nozzle - Modification of bucket ballscrew gear-boxes
OL 78-031	01		Applicable
			Exhaust system -Twin secondary nozzle - Modification of bucket ballscrew gear-boxes
OL 78-032			Applicable
			Exhaust system -Twin secondary nozzle - Modification to doors providing access to the buckets position indicators
OL 78-032	01		Applicable
			Exhaust system -Twin secondary nozzle - Modification to doors providing access to the buckets position indicators
OL 78-032	02		Applicable
			Exhaust system =Twin secondary nozzle = Modification to doors providing access to the buckets position indicators
OL 78-032	03		Applicable
			Exhaust system - Twin secondary nozzle - Modification to doors providing access to the buckets position indicators
OL 78-032	04		Applicable
			Exhaust system - Twin secondary nozzle - Modification to doors providing access to

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
			the buckets position indicators
OL 78-033			Applicable Exhaust system -Twin secondary nozzle - Modification to the drain tube
OL 78-033	01		Applicable Exhaust system -Twin secondary nozzle - Modification to the drain tube
OL 78-034			Applicable Exhaust system -Twin secondary nozzle - Improvement in safety of thrust reverser actuation system
OL 78-034	01		Applicable Exhaust system -Twin secondary nozzle - Improvement in safety of thrust reverser actuation system
OL 78-034	02		Applicable Exhaust system -Twin secondary nozzle - Improvement in safety of thrust reverser actuation system
OL 78-035			Applicable Exhaust system - Twin secondary nozzle doubler - Reinforcing the vertical panels
OL 78-035	01		Applicable Exhaust system - Twin secondary nozzle doubler - Reinforcing the vertical panels
OL 78-035	02		Applicable Exhaust system - Twin secondary nozzle doubler - Reinforcing the vertical panels of the ballscrew gearbox recesses
OL 78-036			Applicable Exhaust system - Twin secondary nozzle blanking of ballscrew gearbox recess
OL 78-036	01		Applicable Exhaust system - Twin secondary nozzle blanking of ballscrew gearbox recess
OL 78-036	02		Applicable Exhaust system - Twin secondary nozzle blanking of ballscrew gearbox recess
OL 78-036	03		Applicable Exhaust system - Twin secondary nozzle blanking of ballscrew gearbox recess
OL 78-037			Applicable Exhaust - Cross feed isolation valve - Position indicator - Replacing the push

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SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
			button switch by a toggle switch
OL 78-038			Applicable Exhaust system - Bucket pneumatic drive actuator - Addition of a temporary LVDT - Core stop device
OL 78-039			Applicable Exhaust system - Twin secondary nozzle - Modification to the downstream section upper and lower panels
OL 78-039	01		Applicable Exhaust system - Twin secondary nozzle - Modification to the downstream section upper and lower panels
OL 78-040			Applicable Exhaust system - Twin secondary nozzle locking of the buckets at the 10 degree position
OL 78-040	01		Applicable Exhaust system - Twin secondary nozzle locking of the buckets at the 10 degree position
R OL 78-040	02		Applicable Exhaust system - Twin secondary nozzle locking of the buckets at the 10 degree position
OL 78-041			Applicable Primary nozzle - Replacement of fixing bolts on actuated flap twin yokes
R OL 78-042			Applicable Exhaust - Thrust reverser pneumatic drive actuator - Modification of guide on pilot regulator
R OL 78-043			Applicable Exhaust - Bucket pneumatic drive actuators - Modification of L.V.D.T. Teflon tube
R OL 78-044			Applicable Engine - Reheat jet pipe linkage - Replacement of the angular position stop and spherical joint housings attachment bolts of the engine reheat jet pipe linkage

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
OL 78-045			Applicable Exhaust System - Twin secondary nozzle - Replacement of the connector on the primary nozzle area transducer harness
OL 78-046			Applicable Exhaust System - Twin secondary nozzle - Ground test connector 301-234-102-0 - Improvement of safety of the lever and valve assy 300-832-822-0
OL 78-047			Applicable Exhaust System - Telescopic tube (78-31-12) - Addition of a failsafe installation spring ring.
OL 78-048			Not Applicable Exhaust System - Thrust reverser pneumatic drive actuator - rework the thrust reverser pneumatic drive actuator, PN126464-1 to PN126464-2
R OL 78-048	01		Not Applicable Exhaust System - Thrust reverser pneumatic drive actuator - rework the thrust reverser pneumatic drive actuator, PN126464-1 to PN126464-2
R OL 78-049			Not applicable Exhaust System - Twin Scondary Nozzle - Replacement of the attachment clamps on the primary nozzle area transducer harness
R OL 78-050			Not applicable Exhaust - Thrust Reverser System - Nozzle and thrust reverser controller assembly (NTRC)

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
SB 77-001		Feb 28/78	Embodied Engine Indicating. AJ indicators - To identify the reheat operating sector to the primary nozzle area
SB 78-001			Not applicable Exhaust. Twin Secondary Nozzle - To record the introduction of OLY Mod. T28206 (FIT 345)
SB 78-002			Not applicable Exhaust. Twin Secondary Nozzle - To record the introduction of SNECMA (FIT 353) (R-R/SNECMA SB OL.593-78-28207-18)
SB 78-003			Applicable Exhaust. T28 Secondary Nozzle - To record the introduction of OLY Mod. 28208 (FIT 355)
SB 78-004			Not applicable
SB 78-005			Not applicable Exhaust. Twin Secondary Nozzle - To introduce OLY Mod. 28211 to the lower access doors (For bucket position transmitters - sealing and drainage) (R-R/SNECMA SB OL.593-78-28211-22)
SB 78-005	01		Not applicable Exhaust. Twin Secondary Nozzle - To introduce OLY Mod. 28211 to the lower access doors (For bucket position transmitters - sealing and drainage) (R-R/SNECMA SB OL.593-78-28211-22)
SB 78-006			Applicable Exhaust. Secondary Nozzle System - To reinstate the position indication detector unit (P.I.D.U.) 27° signal to the air shut-off valve (A.S.O.V.) control in the secondary nozzle system
SB 78-006	01		Applicable Exhaust. Secondary Nozzle System - To reinstate the position indication detector unit (P.I.D.U.) 27° signal to the air shut-off valve (A.S.O.V.) control in the secondary nozzle system
SB 78-006	02		Applicable Exhaust. Secondary Nozzle System - To reinstate the position indication detector unit (P.I.D.U.) 27°signal to the air shut-off valve (A.S.O.V.) control in the secondary nozzle system

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
SB 78-006	03		Applicable Exhaust. Secondary Nozzle System - To reinstate the position indication detector unit (P.I.D.U.) 27° signal to the air shut-off valve (A.S.O.V.) control in the secondary nozzle system
SB 78-007			Applicable Exhaust. Twin Secondary Nozzle - To introduce addition of further fairleads at bucket flexible drives (R-R/SNECMA S.B. OL 593-78-28210-21)
SB 78-008			No effect Exhaust. Twin Secondary Nozzle - To introduce R-R/SNECMA Mod. OLY 28217 Title: Exhaust system. Twin Secondary Nozzle Doubler - Reinforcing the vertical panels of the ballscrew gearbox recesses (R-R/SNECMA S.B. OL 593-78-28217-35)
SB 78-009			No effect Exhaust. Thrust reverser system - To modify the reverse thrust lever mechanism
SB 78-009	01		No effect Exhaust. Thrust reverser system - To modify the reverse thrust lever mechanism
SB 78-010			No effect Exhaust. Primary Nozzle - To revise the method of adjustment on the control system mounting tray attachment
SB 78-010	01		No effect Exhaust. Primary Nozzle - To revise the method of adjustment on the control system mounting tray attachment
SB 78-011			No effect Exhaust. Twin Secondary Nozzle - To introduce R-R/SNECMA Mod. OLY 28218 Title: Exhaust System - Twin Secondary Nozzle blanking of ballscrew gearbox recesses (R-R/SNECMA SB OL.593-78-28218-36)
SB 78-012			Not applicable Exhaust. Complement to MRB document (Ballscrew gearbox lubrication and Bucket Position Transmitter Indicator trunnion wear check)

	SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
	SB 78-012	01		Not applicable Exhaust. Complement to MRB document (Ballscrew gearbox lubrication and Bucket Position Transmitter Indicator trunnion wear check)
	SB 78-013			Embodied Exhaust. Thrust reverse safety systems - Revision to the frequency of maintenance tasks
	SB 78-A-014			Not applicable Powerplant Exhaust. Secondary nozzle control and safety circuit
	SB 78-015			Applicable Thrust reverser - Secondary Nozzle Control and Safety Circuits Modifications
	SB 78-015	01	Mar 31/99	Embodied Thrust reverser - Secondary Nozzle Control and Safety Circuits Modifications
R	SB 78-016			No effect Engines - Thrust Reversers - Suppression of transient voltages causing damage to contacts of ECE relay Type 1485Y2
R	SB 78-017			No effect Trial installation and test of modified nozzle and thrust reverser controllers
R	SB 78-017	01		No effect Trial installation and test of modified nozzle and thrust reverser controllers
R	SB 78-018			No effect Install modified nozzle and thrust reverser controllers P/N 121562-9
R	SB 78-018	01		No effect Install modified nozzle and thrust reverser controllers P/N 121562-9
R	SB 78-018	02		No effect Install modified nozzle and thrust reverser controllers P/N 121562-9
R	SB 78-018	03		No effect Install modified nozzle and thrust reverser controllers P/N 121562-9
R	SB 78-019			No effect Install modified nozzle and thrust reverser controller P/N 121562-10-1

CHAPTER 78

EXHAUST

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EXHAUST - GENERAL

1. General (Ref. Fig.001 and 002)

The exhaust assembly is composed of three main modules, namely the reheat jet pipe, the primary nozzle and the twin secondary nozzle. In the reheat jet pipe burns the fuel injected during the reheat sequences, namely at the beginning of take-off and transonic acceleration. The primary nozzle area is varied by pneumatically actuated petals, ensuring optimum performance over a wide range of aircraft speed and engine RPM. These two first modules form the primary assembly.

Twin secondary nozzles carry primary nozzles, each rigidly fitted by three mounting pins. Buckets are fitted at the rear of the twin secondary nozzle. Their systems optimize the performances of the power units by controlling exhaust gases expansion and provide reverse thrust on flight deceleration and landing by closing the buckets.

2. Primary Assembly Attachment Principle.

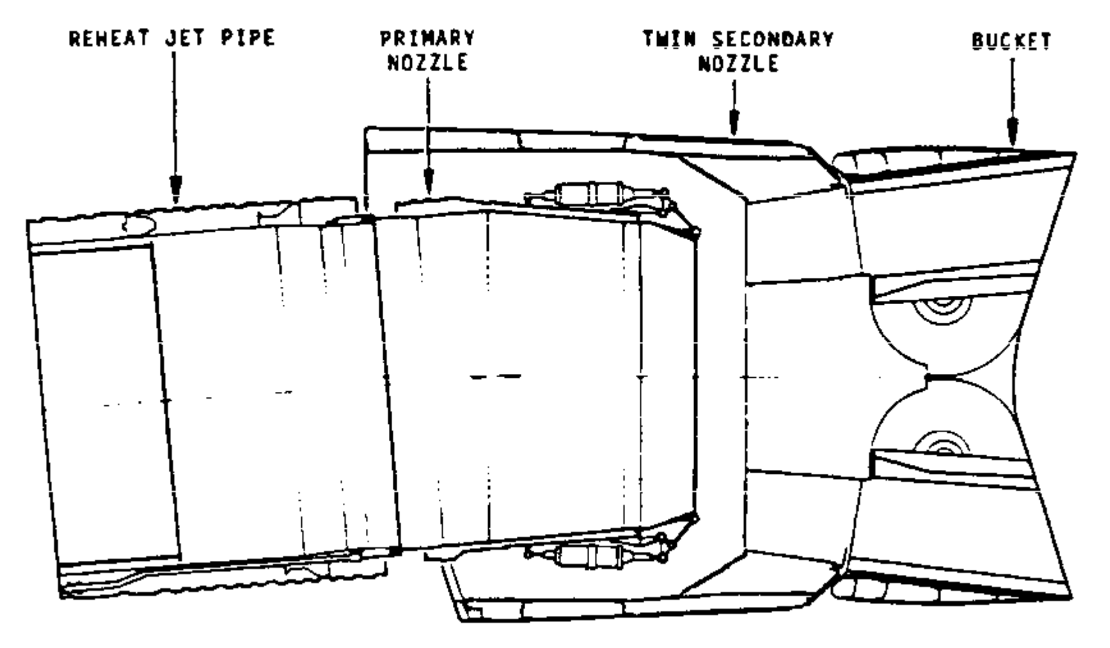
The reheat jet pipe is connected on engine and primary nozzle sides by sliding spherical flanges. This layout permits a flexible mounting which will adapt itself to the geometrical configurations of the exhaust assemblies according to whether the engine is mounted to the left or right of the nacelle and facilitates removal and installation of the reheat jet pipe.

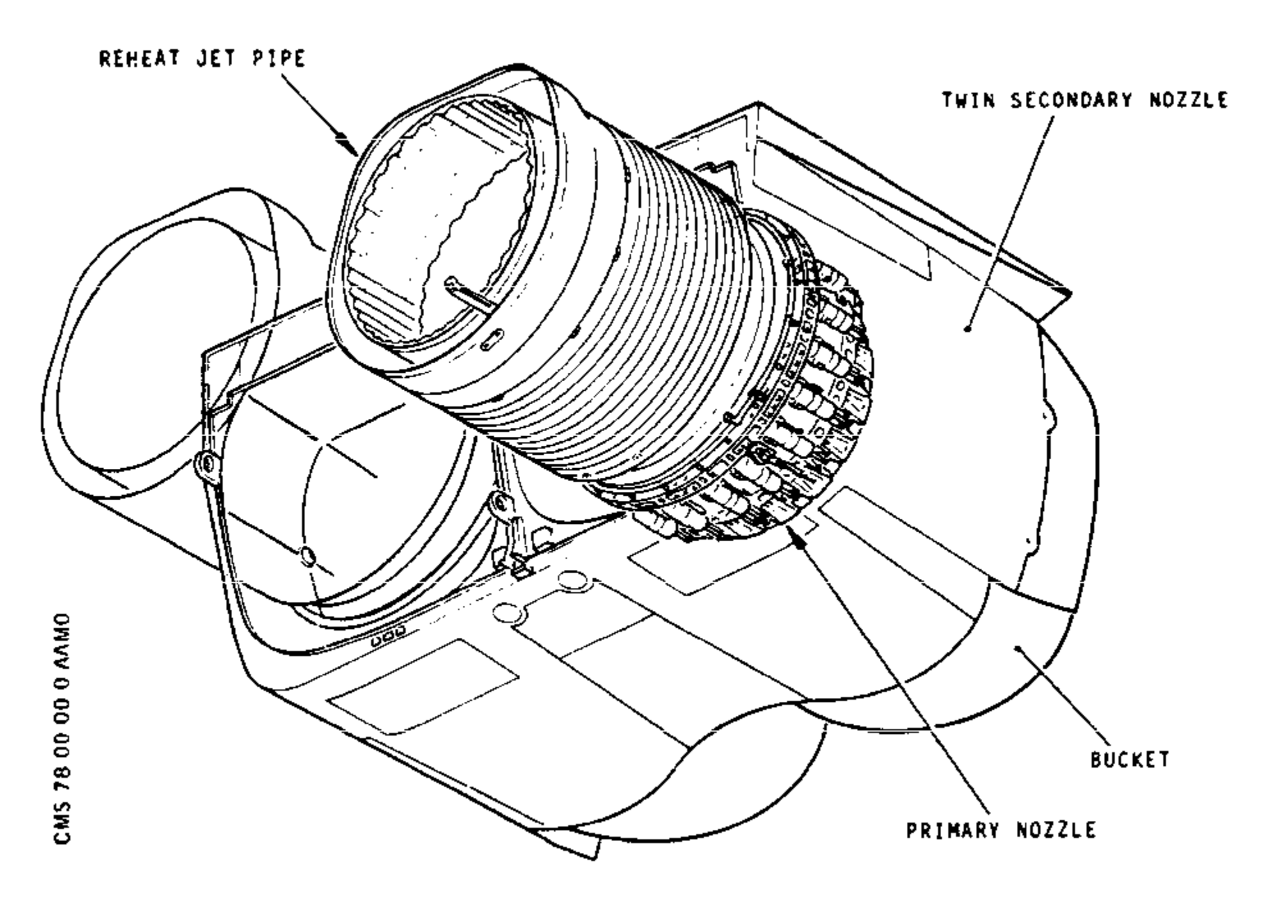
Detailed description of the reheat jet pipe and primary nozzle is dealt with in paragraph 78-10-00.

3. Twin Secondary Nozzle and Buckets.

The twin secondary nozzle is a one-piece assembly making up the rear part of the nacelle on which it is secured by four yokes. Most of its structural components are formed of honeycomb material. The two secondary nozzles are dissimilar, taking into account the geometry evolution of the nacelles between two adjacent engines and the symetrical axis of the aircraft.

The twin secondary nozzle supports the primary nozzles and the bucket systems, ducts the secondary air and transmits to the aircraft structure the whole of the load from the primary and secondary exhaust systems.





R Exhaust Assembly
Figure 001

P3 ADAPTOR
P3 SIGNAL PIPE (PJ)
BUCKET PNEUMATIC DRIVE ACTUATOR (BPDA)
P3 SUPPLY PIPE
CROSSFEED ISOLATION VALVE
P3 SIGNAL PIPE
FLEXIBLE HOSE
NACELLE CENTRE WALL
PRIMARY NOZZLE JACK
PRIMARY NOZZLE SUPPLY PIPE
GROUND CONNECTOR
PRIMARY NOZZLE TRIM UNIT
PRIMARY NOZZLE CONTROL VALVE
TWIN SECONDARY NOZZLE

SIGNALS
PJ P3
P3
PRIMARY NOZZLE TRIM UNIT
PRIMARY NOZZLE CONTROL VALVE
PRIMARY NOZZLE JACK
PRIMARY NOZZLE AIR SYSTEM

TEST CONNECTOR
P3
BUCKET PNEUMATIC DRIVE ACTUATOR (BPDA)
CROSSFEED ISOLATION VALVE
GROUND CONNECTOR
P3
BPDA
SECONDARY NOZZLE AIR SYSTEM

CMS 78 00 00 0 BAMO

Exhaust Assembly Air System
Figure 002

R

BUCKET CONTROL SYSTEM - REMOVAL/INSTALLATION

1. General

The deactivation/reactivation procedure described in this chapter is to be applied when the reverse system on one nacelle is defective, and the stopover time does not allow immediate reconditioning. In this case, it is possible to clear the aircraft for another flight by bringing the buckets to the 10° position and locking the complete system at the pneumatic drive actuator position. This operation is implemented by means of a "system manual lockout" located on the pneumatic drive actuator. This lockout, when engaged, pressurizes and closes the inlet shut-off valve, and physically engages a pin into one of the pneumatic actuator rotors, thus preventing the rotor from turning.

In case of failure of one or more bucket flexible shaft it is required to lock the bucket ballscrews at the ballscrew gearbox by installing a cover assembly lock in lieu of the access cover. (Refer to Figure 401).

A. Locking of buckets without failure of a bucket flexible shaft:

Lock the bucket pneumatic drive actuator or one of the upper bucket ballscrew gearbox.

B. Locking of buckets with one or more failed bucket flexible shaft :

Lock the bucket pneumatic drive actuator and one of the lower bucket ballscrew gearbox.

NOTE: If you lock the bucket ballscrew gearbox without locking the bucket pneumatic drive actuator there is a risc of over heating the pneumatic drive actuator.

As a consequence reduce the number of flight performed in this configuration to the absolute minimum required to return the aircraft to the main base.

2. Deactivation of the Bucket Control System

A. Equipment and Materials

DESCRIPTION	PART NO.
Extension	9970-515-296
Pneumatic vibration screwdriver (pre-adjusted at 0.60 daN.m., 53 lbf. in.) and the appropriate screwdriver head.	-
Pneumatic	-

DESCRIPTION	PART No.
impact wrench (unscrewing mode) ARO 8530 PC 1 and the appropriate screwdriver head.	
Circuit breaker safety clips.	-
Cover assembly lock	9970-515-298

B. Preparation

R **WARNING:** MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE ON WHICH THE WORK IS CARRIED OUT.

(1) Electrically isolate the engine and exhaust system services indicated in Table 401 by tripping the circuit breaker which affects the engine to be deactivated.

(2) Fit circuit breaker safety clip.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENGINE No. 1			
R BUCKET CONT UNIT SUP	14-215	1K1132	E12
ENGINE No. 2			
BUCKET CONT UNIT SUP	13-215	2K1132	G14
ENGINE No. 3			
BUCKET CONT UNIT SUP	13-216	3K1132	C6
ENGINE No.4			
BUCKET CONT UNIT SUP	14-216	4K1132	C6

Circuit Breakers
Table 401

NOTES: 1. Tripping the B.C.U. (N.T.R.C.) supply circuit breaker enables the "GO" light to operate irrespective of secondary nozzle position.

2. With the B.C.U. (N.T.R.C.) supply breaker tripped, the associated secondary nozzle position indicator will read 0 degrees.

(3) Display a suitable placard on the engine starting panel, indicating that personnel are working in the engine and twin secondary nozzle area.

C. Deactivation of the bucket control system by locking the bucket pneumatic drive actuator.

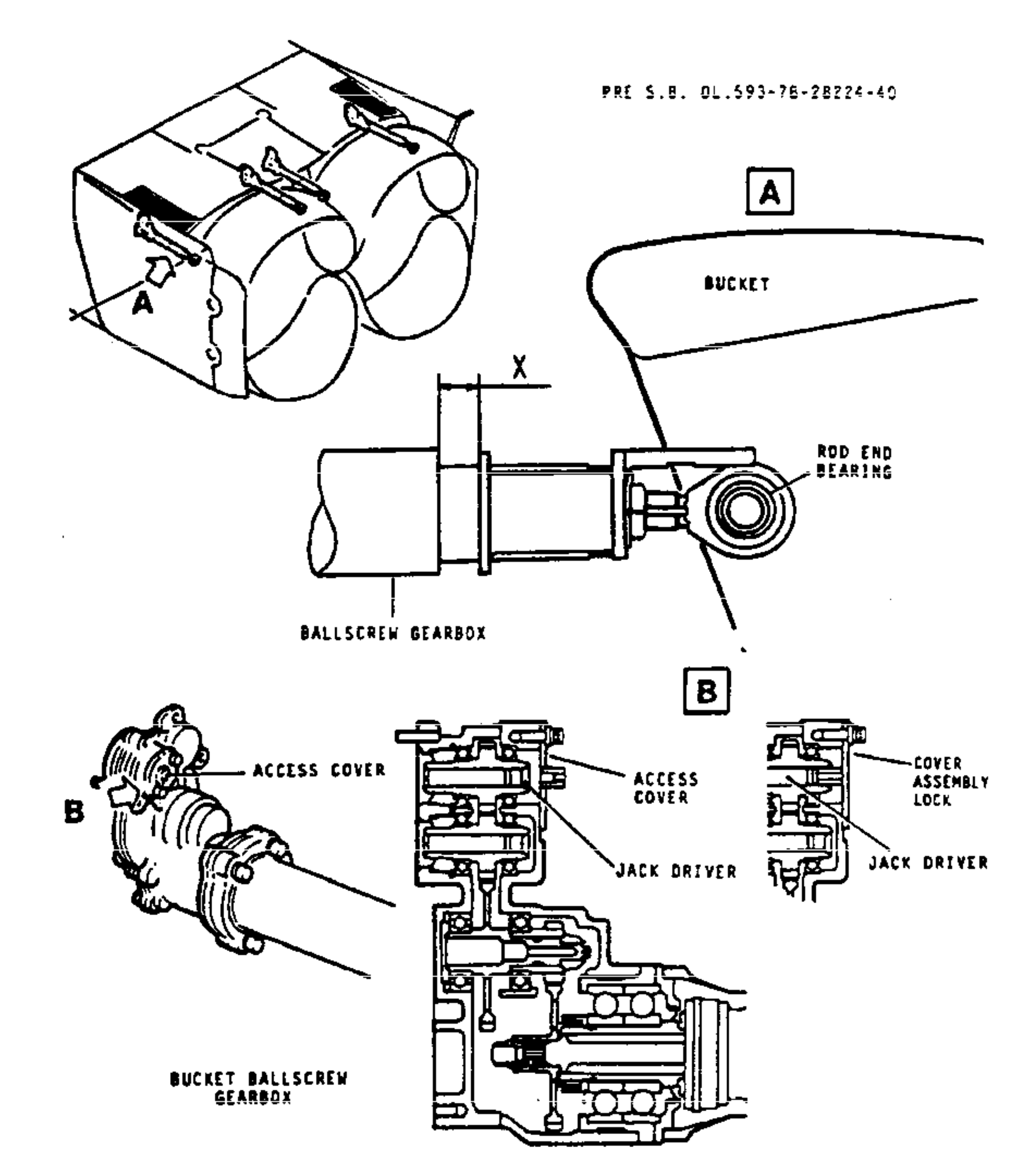
NOTE: During moving of the bucket to 10 degrees position, make sure of a simultaneous and symmetrical movement of the buckets.

(1) Position Buckets at 10 degrees.

R CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD. USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS. BEFORE CARRYING OUT ANY WORK, THE SECONDARY NOZZLE MUST BE LINED WITH RUBBER CARPETS TO AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES MUST ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

(a) Remove the access panels to the upper lateral ballscrew gearbox, and to the bucket pneumatic drive actuator using a pneumatic impact wrench equipped with an appropriate screwdriver head.

(b) Remove the access cover to the ballscrew gearbox driver (Ref. Fig. 401).



R

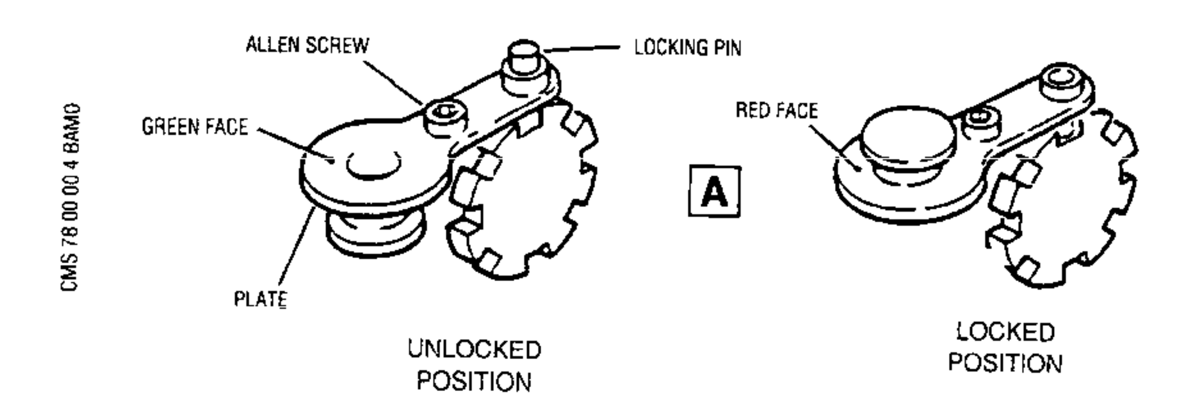
Positioning Buckets to Angle of 10 Degrees
Figure 401

R
R
R
R

CR 36461/00A

A

FORWARD



Locking the Bucket Pneumatic Drive Actuator
Figure 402

R B CAUTION: IT IS IMPORTANT THAT THE BUCKET POSITION
B TRANSMITTER IS SET AT THE SAME
B POSITION AS THE BUCKETS. THIS IS OF
B PARTICULAR SIGNIFICANCE FOLLOWING
B FAILURE OF THE BUCKET DRIVE SYSTEM.
B FAILURE TO OBSERVE THIS PRECAUTION
B MAY RESULT IN IMPAIRED ENGINE OPERATION.

(c) Using the appropriate extension, move the buckets by turning the gearbox driver until the ballscrew gearbox stroke X reaches 37 mm (1.45 in) (Ref. Fig. 401) (Detail A).

NOTE: A ballscrew gearbox stroke of 37 mm (1.45 in) corresponds to a bucket angle of 10 degrees.

(2) Locking the Pneumatic Drive Actuator (Ref. Fig.402).

(a) Unscrew and remove the "Allen" screw securing the locking plate to the pneumatic drive actuator.

R CAUTION: FAILURE TO POSITION THE GEAR PROPERLY FOR INSTALLATION OF THE MANUAL LOCK MAY RESULT IN DAMAGE TO THE UNIT.

(b) Turn the plate over and reposition it on the pneumatic drive actuator, ensuring that the locking pin is correctly engaged in the toothed wheel (Ref. Fig.402) (Detail A).

NOTE: It will be necessary to rotate the drive actuator output shaft plus or minus 30 degrees from the ten-degree position to engage the manual lock. This will be needed to ensure that the manual lock is inserted exactly between two teeth of the gear in the housing.

(c) Screw and tighten the plate attaching bolt.

(d) Install the access cover to the bucket ballscrew gearbox driver and torque tighten the two bolts
R to 0.30 mdaN (25 lbf in).

R CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.
USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

(e) Install the access panels to the bucket pneumatic drive actuator and to the upper lateral ballscrew gearbox and torque the fitting screws to 0.60
R mdaN (53 lbf in) using a pneumatic vibration screwdriver pre-adjusted at the required torquing value and equipped with an appropriate screwdriver head.

D. Deactivation of the bucket control system by locking one ballscrew.

R CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.
USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.
BEFORE CARRYING OUT ANY WORK, THE SECONDARY NOZZLE MUST BE LINED WITH RUBBER CARPETS TO AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES MUST ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

(1) Remove the access panels to the ballscrew using a pneumatic impact wrench equipped with an appropriate screwdriver head.

(2) Remove the access cover to the ballscrew gearbox driver (ref. Figure 401).

R CAUTION: IT IS IMPORTANT THAT THE BUCKET POSITON TRANSMITTER IS SET AT THE SAME POSITION AS THE BUCKETS. THIS IS OF PARTICULAR SIGNIFICANCE FOLLOWING FAILURE OF THE BUCKET DRIVE SYSTEM. FAILURE TO OBSERVE THIS PRECAUTION MAY RESULT IN IMPAIRED ENGINE OPERATION.

(3) Using the appropriate extension, move upper or lower bucket by turning the gearbox driver until the ball-screw gearbox stroke X reaches 37 mm (1.45 in) (ref. Figure 401) (Detail A).

NOTE: A ballscrew gearbox stroke of 37 mm (1.45 in) corresponds to a bucket angle of 10 degrees.

(4) Insert the cover assembly lock in the bucket ball-screw gearbox jack driver and torque tighten the
R two bolts to 0.30 mdaN (25 lbf in) (ref. Figure 401) (Detail B).

(5) Install the access panels to the upper ballscrew or lower ballscrew and torque the fitting screws to
R 0.60 mdaN (53 lbf in) using a pneumatic vibration screwdriver pre-adjusted at the required torquing value and equipped with an appropriate screwdriver head.

E. Conclusion.

Remove the placard displayed on the engine starting panel, indicating that personnel are working in the engine and twin secondary nozzle area.

3. Reactivation of the Bucket Control System

A. Equipment and Materials

DESCRIPTION	PART No.
Pneumatic vibration screwdriver (pre-adjusted at 0.60 daNm., 53 lbf in) and the appropriate screwdriver head.	-
Pneumatic impact wrench (unscrewing mode) ARO 8530 PC 1 and the appropriate screwdriver head.	-
Circuit breaker safety clips	-

B. Preparation

R WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE ON WHICH THE WORK IS CARRIED OUT.

(1) Check that the circuit breaker isolating the engine and secondary nozzle on which work is going to be carried out is still in the tripped position (Ref. Table 401).

(2) Display a suitable placard on the engine starting panel, indicating that personnel are working in the engine and twin secondary nozzle area.

C. Unlocking the Bucket Pneumatic Drive Actuator.

R CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.
USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.
BEFORE CARRYING OUT ANY WORK, THE SECONDARY NOZZLE MUST BE LINED WITH RUBBER CARPETS TO AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES MUST ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

(1) Remove the access panel to the bucket pneumatic drive actuator, use a pneumatic impact wrench equipped with an appropriate screwdriver head.

(2) Unscrew and remove the "Allen" screw securing the locking plate to the pneumatic drive actuator.

(3) Turn the plate over and reposition it on the pneumatic drive actuator, ensure that the locking pin is visible on the top of the plate (Ref. Fig.402) (Detail A).

(4) Screw and tighten the plate attaching bolt.

R CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.
USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

(5) Install the access panel to the bucket pneumatic drive actuator and torque the fitting screws to 0,60 daNm (53 lbf in) using a pneumatic vibration screwdriver pre-adjusted at the required torque value and equipped with an appropriate screwdriver head.

D. Unlocking the Upper or Lower Ballscrews

R CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD. USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO DERTERIORATION OF THE SCREWS.

BEFORE CARRYING OUT ANY WORK, THE SECONDARY NOZZLE MUST BE LINED WITH RUBBER CARPETS TO AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES MUST ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

(1) Remove the access panels to the upper ballscrew or lower ballscrew using a pneumatic impact wrench equipped with an appropriate screwdriver head.

(2) Remove the cover assembly lock engaged in the bucket ballscrew gearbox jack drivers.

(3) Install the access covers to the bucket ballscrew gearbox drivers and torque tighten the two bolts to 0.30 daNm (25 lbf in) (ref. Figure 401).

(4) Install the access panels to the upper ballscrew or lower ballscrew and torque the fitting screws to 0.60 daNm (53 lbf in) using a pneumatic vibration screwdriver pre-adjusted at the required torquing value and equipped with an appropriate screwdriver head.

E. Conclusion

(1) Remove the circuit breaker safety clips and reset the breaker (Ref. Table 401).

(2) Remove the placard displayed on the engine starting panel, indicating that personnel are working in the engine and twin secondary nozzle area.

BUCKET CONTROL SYSTEM - ADJUSTMENT/TEST

1. General

The operational test described hereafter may be carried out, depending on the circumstances, either with the engines in static state, using a compressed air source to be connected to the ground test connection or with the engines operating during a ground run or aircraft taxiing.

Paragraph 2 describes the operational tests carried out on engines in static state, using a compressed air source. The crossfeed isolation system is open for operation of both bucket systems on the same twin secondary nozzle using a single ground test connection only.

Paragraph 3 describes the operational tests carried out with engines running.

The functional tests detailed in paragraph 4 are performed following the removal/installation of a twin secondary nozzle deemed to be in a good operating condition. This removal has been carried out for any aircraft structural maintenance reasons. The checks are performed mainly to ensure that the pneumatic and electric connections have been correctly restored and that the performances expected from the control system are met. They are also performed in accordance with the Maintenance Programme.

WARNING: BEFORE CONNECTING ANY AIR SOURCE TO THE GROUND TEST CONNECTOR, ENSURE THAT AREAS ADJACENT TO THE TWO BUCKET SYSTEMS OF THE TWIN SECONDARY NOZZLE ARE CLEAR OF PERSONNEL AND EQUIPMENT.
R AFTER COMPLETION OF ANY TEST NECESSITATING AN EXTERNAL
R AIR SOURCE IT IS IMPERATIVE TO BLANK THE GROUND TEST
R CONNECTOR WITH THE PIPE CLOSURE NUT AND LOCKWIRE.

2. Operational Tests - Engines in Static State. (Ref. Fig. 501).

A. Equipment

DESCRIPTION	PART NO.
3 bars (43 psig) air pressure source	

B. Preparation

(1) Fully close manually the primary nozzle.

(2) Ensure that the bucket system circuit breakers listed in Table 501 are set.

(3) Connect the external power supplies: 28 Vdc and 115 V - 400 Hz (Ref. 24-41-00, Servicing).

(4) Position the 4 throttle levers fully rearward in their gates with thrust reverse levers fully down.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No. 1			
WIND DOWN CONT SUP 2	1-213	1K1108	C 7
PP MGT LTS SUP (crossfeed)		2E 461	E 3
MAIN THROT SUP	2-213	1K 1	F12
MAIN THROT CONT	3-213	1K 3	A 1
REV THRUST CONT		1K 331	D 1
REV THRUST ASOV CONT		1K 334	G 3
R NOZ O/RIDE ENG 1-4		E 582	G 6
REV BUCKET POSN IND	5-213	1E 121	A 3
WIND DOWN CONT SUP 1		1K1101	B 1
PP MGT LTS SUP		1E 461	D 1
BUCKET CONT UNIT SUP	14-215	1K1132	E12
REHEAT CONT	15-216	1K1542	E 9
Engine No. 2			
MAIN THROT CONT	1-213	2K 3	A 3
REV THRUST CONT		2K 331	B 5
REV BUCKET IND POSN		2E 121	B 7
REV THRUST ASOV CONT		2K 334	D 7
PP MGT LTS SUP (crossfeed)		2E 461	E 3
WIND DOWN CONT SUP 1		2K1101	F 4
R NOZ O/RIDE ENG 2-3		E 583	G 7
R NOZ O/RIDE IND ENG 2-3		E 584	G 8
MAIN THROT SUP	2-213	2K 1	C12
WIND DOWN CONT SUP 2	5-213	2K1108	C 1
PP MGT LTS SUP		1E 461	D 1
BUCKET CONT UNIT SUP	13-215	2K1132	G14
REHEAT CONT	15-215	2K1542	D15
Engine No. 3			
MAIN THROT CONT	1-213	3K 3	A 4
REV THRUST CONT		3K 331	B 6
REV BUCKET POSN IND		3E 121	B 8
PP MGT LTS SUP (crossfeed)		3E 461	E 4
REV THRUST ASOV CONT		3K 334	D 8
WIND DOWN CONT SUP 1		3K1101	F 5
R NOZ O/RIDE ENG 2-3		E 583	G 7
R NOZ O/RIDE IND ENG 2-3		E 584	G 8
WIND DOWN CONT SUP 2	5-213	3K1108	C 2
PP MGT LTS SUP		4E 461	D 2
BUCKET CONT UNIT SUP	13-216	3K1132	C 6
REHEAT CONT	15-215	3K1542	D16

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SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
Engine No. 4			
WIND DOWN CONT SUP 2	1-213	4K1108	C 8
PP MGT LTS SUP (crossfeed)		3E 461	E 4
MAIN THROT SUP	2-213	4K 1	F13
MAIN THROT CONT	3-213	4K 3	A 2
REV THRUST CONT		4K 331	D 2
REV THRUST ASOV CONT		4K 334	G 4
R NOZ O/RIDE ENG 1-4		E 582	G 6
REV BUCKET POSN IND	5-213	4E 121	A 4
WIND DOWN CONT SUP 1		4K1101	B 2
PP MGT LTS SUP		4E 461	D 2
BUCKET CONT UNIT SUP	14-216	4K1132	C 6
REHEAT CONT	15-216	4K1542	E10

NOTE: Whatever engine bay is undergoing the test, each of the circuit breaker "REHEAT CONT" must be switched "ON" to permit performance of crossfeed isolation circuit test.

Circuit Breakers
Table 501

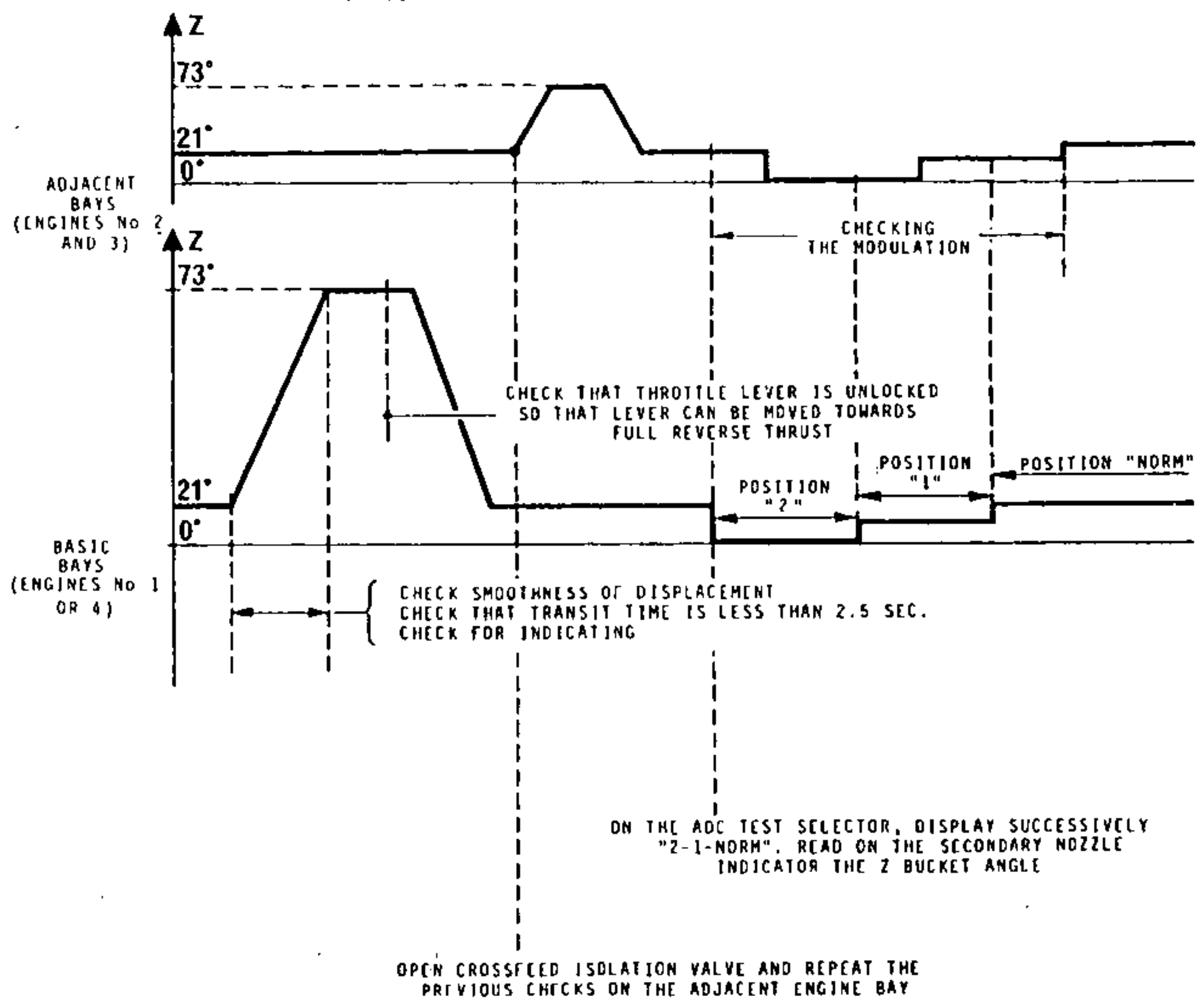
C. Wind-Down Test

(1) Check that NOZ AIR SOV AND WIND-DOWN TEST switch is in OFF position.

(2) Set THROTTLE MASTER switch to position MAIN and check that REV and WIND-DOWN captions are extinguished.

(3) Position the main throttle lever fully forward and place the NOZ AIR SOV AND WIND-DOWN TEST switch as follows:

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Operational Tests on the Bucket System
Engine Static
Figure 501

(a) OFF: Check that thrust reverse lever cannot be engaged.

(b) At position A: Check that the blue REV caption illuminates steadily.

(c) At position B: Check that the blue REV caption remains illuminated and that the yellow WIND-DOWN caption also illuminates.

(d) At position C: Check that the yellow WIND-DOWN caption is extinguished and that the REV caption changes from steady illumination to flashing.

(4) Position the forward throttle lever to idle. Move the wind-down test switch to position B and check that the REV caption illuminates.

(5) Position the reverse throttle lever above idle then move NOZ AIR SOV AND WIND-DOWN TEST switch to OFF position. Check that the REV caption is extinguished and that WIND-DOWN caption illuminates.

(6) Move the thrust reverse lever fully down and check that WIND-DOWN caption is extinguished.

D. A.S.O.V. Test

(1) Cut and remove lockwire. Unscrew and remove the pipe closure nut from the ground test connector.

WARNING: AS SOON AS AIR PRESSURE IS APPLIED TO THE BUCKETS CONTROL SYSTEM, THE BUCKETS MIGHT MOVE WITHIN THE ANGULAR RANGE 0 TO 21 DEGREES. ENSURE THAT PERSONNEL AND EQUIPMENT ARE CLEAR OF THE AREA SURROUNDING THE BUCKETS.

(2) Connect the 3 bar (43 psig) compressed air source to the ground test connection on engine bays No. 1 and 4.

NOTE: The pneumatic source capacity should be such that the supply pressure measured upstream of the ground test connection does not drop under 2.5 bar observed on the pressure gauge (36 psig) during total transit time of buckets.

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NOTE: The 27° SECURITY test switches on panel 15-214 can be used to check the functionality of the 27° switch within NTRC and the PIDU independently of each other, for engines 1 and 4 and/or engines 2 and 3, by selecting the TEST NTRC or TEST PIDU position. Selection of the switches to the NORM position connects the NTRC and PIDU 27° switches in parallel for normal flight operation.

(3) Position the throttle lever at forward idle.

(a) Place the 27° SECURITY test switch to the TEST PIDU position for engines 1 and 4.

(b) Ensure respective test lamps are illuminated.

(c) Place the engine 1 and 4 NOZ AIR SOV AND WIND-DOWN TEST switch to position E.

(d) Check that REV caption flashes continuously and the WIND-DOWN caption illuminates.

(4) Position the thrust reverse lever to idle with the NOZ AIR SOV AND WIND-DOWN TEST switch still at position E. The buckets will rotate. The A.S.O.V. should close at 27° stopping the buckets at approx. 35°. The WIND-DOWN caption will be extinguished. If the buckets reach the 73° position, this indicates failure of the PIDU/NTRC switch selected for test.

(5) Move NOZ AIR SOV AND WIND-DOWN TEST switch to position D. The buckets will remain at the same position as above and WIND-DOWN caption will illuminate.

(6) Move the NOZ AIR SOV AND WIND-DOWN TEST switch to OFF position with thrust reverse still selected.

(a) Check that the buckets continue to rotate towards 73°.

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R (b) Check that REV caption flashes in transit and steady illuminates when buckets reach the 73° position.

(c) Check that WIND-DOWN caption is extinguished.

(7) Position the thrust reverse lever fully down.

(a) Check that buckets return to forward thrust position.

(b) Check that REV caption flashes then extinguishes.

(c) Check that WIND-DOWN caption is extinguished.

R (d) Repeat checks detailed in steps D.(3)(b) to (7)(c) with the 27° SECURITY test switch in the TEST NTRC position.

R (e) Return 27° SECURITY test switch to NORM position and ensure test lamps are extinguished.

(8) On the adjacent bay, repeat checks detailed in steps D.(2) to (6). Open the crossfeed isolation valve and use engine 2 and 3 NOZ AIR SOV AND WIND DOWN TEST switch and 27° SECURITY test switches instead of engine 1 and 4 TEST switches.

(a) Switch on FLIGHT REVERSE ARM, check that the OPEN caption illuminates and that the FLIGHT REVERSE ARM switch remains latched in.

(b) On the adjacent bay (engine 2 or 3) repeat checks previously carried out in steps D (2) to (6).

E. Checking the "Forward Thrust/Reverse Thrust" Motions.

(1) Pull the thrust lever to the intermediate baulk and observe buckets and indicators for the following:

(a) Check for bucket smoothness of displacement.

(b) Check for the slowing down of bucket motion, at end of travel.

(c) Check that the REV indicating light operates normally. This light should be flashing during travel and show steady illumination when buckets are at end of travel, in "Reverse Thrust" position.

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(d) Check that transit time does not exceed 2.5 seconds.

NOTE: If transit time exceeds 2.5 seconds, carry out measurement of drag torque over the full bucket system travel. This should be less than 0.20 daNm (17.7 lbf in). If satisfactory, refer to Trouble Shooting, Chapter 71-00-51.

(e) Check that, at end of travel, the throttle lever is unlocked and can be moved towards "Normal/ Thrust reverse".

(f) Check that CON caption light remains off.

(2) Position the thrust reverse lever down in the forward baulk position and observe buckets and indicators.

(a) Repeat checks carried out in steps (a) through (d) above and check that final position is within 18° 30 and 23° 30.

(b) When the buckets have moved back to the Forward thrust position, check that the throttle lever is unlocked and can be moved towards Full throttle/Forward thrust.

(3) On the adjacent bay, repeat checks detailed in steps E.(1) and (2) by actuating open the crossfeed isolation valve.

(a) Position all four throttle levers fully rearward their gates with thrust reverse levers fully down.

(b) Switch on FLIGHT REVERSE ARM. Check that the OPEN caption illuminates and that the FLIGHT REVERSE ARM switch remains latched in.

(c) On the adjacent bay (Engine No. 2 or 3), repeat the checks previously carried out in steps E.(1) and (2).

NOTE: Because the pneumatic supply is made via the crossfeed isolation valve, the bucket travel
R time will be completed within 2 and 3.5 seconds.

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F. Checking the Modulation

(1) Set the SECONDARY AIR DOORS switches in the SHUT position and trip the circuit breaker REV THRUST ASOV CONT.

(2) Depress the amber ADC FAIL caption and place the ADC test selector in position 2. Check that the bucket angular position observed on the SECONDARY NOZZLE indicator is within + 1 and - 1 degree.

(3) On the adjacent bay, repeat the above check (2) by actuating open the crossfeed isolation valve.

(4) Keep depressed the amber ADC FAIL caption and place the ADC test selector in position 1. The bucket angular position observed on indicator must be within 16° and 21°.

(5) On the adjacent bay, repeat the above check (4) by actuating open the crossfeed isolation valve.

(6) Keep depressed the amber ADC FAIL caption and place the ADC test selector in NORM position. The bucket angular position observed on SECONDARY NOZZLE indicator must be within 18° 30 and 23° 30.

(7) On the adjacent bay, repeat the above check (6) by actuating open the crossfeed isolation valve.

(8) Reset the SECONDARY AIR DOORS switches in the SHUT position.

B G. Operational Check of 45 Degree Switch in P.I.D.U. (Bucket
B position transmitter).

B (1) Select the throttle master switches to MAIN or ALTERNATE position.

B (2) Check that the NOZ and WIND DOWN test switch is in the
B OFF position.

B (3) Check that the WIND DOWN captions are extinguished.

B (4) Position the throttle lever fully forward.

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(5) Trip the following circuit breakers.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 2 REV THRUST ASOV CONT	1-213	2K 334	D 7
ENG 3 REV THRUST ASOV CONT		3K 334	D 8
ENG 1 REV THRUST ASOV CONT	3-213	1K 334	G 3
ENG 4 REV THRUST ASOV CONT		4K 334	G 4

B (6) Locate the nozzle thrust reverse controllers (NTRC)
B 4 off, mounted in the forward racking on shelves
B 14.215, 13.215, 13.216 and 14.216.

B (7) Short pins "P" and "N" together on test socket J2 of
B each B.C.U.

(8) Check the WIND DOWN caption illuminates during secondary nozzle transit (approx. 45 degrees).

(9) Remove the short from pins "P" and "N" of each NTRC and check that the secondary nozzles return to the forward thrust position and that the WIND DOWN captions extinguish.

(10) Reset the circuit breakers tripped in step (5).

(11) Return the throttle levers to idle.

R After SB 78-018

R G. Operational Check of 45 Degree Switch in P.I.D.U. (Bucket
R position transmitter).

R (1) Carry out Functional Test detailed in paragraph 4.C.
R Static Test.

B B (4) With the amber ADC FAIL caption held depressed, place the ADC test selector to NORM position.

B (5) Disconnect the air supplies from the ground test connection.

B B (6) Disconnect the compressed air supply hose from the ground test connector.

B (7) Re-blank the ground test connector. Torque the pipe closure nut to 25.81 lbf ft (3.5 mdaN) and lockwire (Ref. 20-21-13).

CAUTION: FAILURE TO CORRECTLY REPLACE AND SECURE THE PIPE CLOSURE NUT COULD RESULT IN HOT AIR LEAKAGE WITH CONSEQUENT DAMAGE TO ADJACENT WIRING LOOMS AND COMPONENTS.

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After SB 78-018

H. Nozzle Override Warning Light/LVDT Monitor Check.

(1) Locate the nozzle thrust reverse controllers (NTRC) (4 off) mounted in the forward racking on shelves 14.215, 13.215, 13.216 and 14.216 for the appropriate NTRC under test.

(2) For Outboard Engines 1 and 4.

(a) On NTRC 1 (4) test socket J2 short circuit pins "P" and "N".

(b) Check that the associated Engine Nozzle O/Ride warning light on panel 15-214 illuminates.

(c) Remove the short circuit pins, open and reset the following circuit breakers and check that the warning light extinguishes.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NOZZLE O/RIDE ENG 1-4	3-213	E582	G 6
BUCKET CONTROL UNIT SUPPLY ENG 1	14-215	1K1132	E12
BUCKET CONTROL UNIT SUPPLY ENG 4	14-216	4K1132	C 6

(3) For Outboard Engines 2 and 3.

(a) On NTRC 2 (3) test socket J2 short circuit pins "P" and "N".

(b) Check that the associated Engine Nozzle O/Ride warning light on panel 15-214 and 1-214 illuminates.

(c) Check that the NOZZLE O/RIDE ENG 2-3 light illuminates.

(d) Remove the short circuit pins, open and reset the following circuit breakers and check that the warning light extinguishes.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NOZZLE O/RIDE IND ENG 2-3	1-213	E584	G 8
NOZZLE O/RIDE ENG 2-3	1-213	E583	G 7
BUCKET CONTROL UNIT SUPPLY ENG 2	13-215	2K1132	G14
BUCKET CONTROL UNIT SUPPLY ENG 4	13-216	2K1132	C 6

R J. Conclusion

(1) Position any throttle lever above idle and check that the switch FLIGHT REV ARM is unlatched.

B (2) Set the SECONDARY AIR DOOR switches to SHUT position.

B (a) Depress the amber ADC FAIL caption and place the ADC test selector to position 2. Check the indicated Mach No. is greater than 1.3.

B (3) Check the pneumatic drive actuator pneumatic pipes and exhaust outlets for leaks at the zero degree position. Pay particular attention to the telescopic tubes. Rectify as required.

B (4) With the amber ADC FAIL caption held depressed, place the ADC test selector to NORM position.

B (5) Disconnect the air supplies from the ground test connection.

B (6) Disconnect the compressed air supply hose from the ground test connector.

R CAUTION: FAILURE TO CORRECTLY REPLACE AND SECURE THE PIPE CLOSURE NUT COULD RESULT IN HOT AIR LEAKAGE WITH CONSEQUENT DAMAGE TO ADJACENT WIRING LOOMS AND COMPONENTS.

B (7) Re-blank the ground test connector. Torque the pipe closure nut to 25.81 lbf ft (3.5 mdaN) and lockwire (Ref. 20-21-13).

3. Operation Tests - Engine Running (Ref. Fig. 502)

A. Wind-Down Test before Engine Start

(1) Check that the NOZ AIR SOV AND WIND-DOWN TEST switch is in OFF position.

(2) Set the THROTTLE MASTER switch to the MAIN position and check that the REV and WIND-DOWN captions are extinguished.

(3) Position the main throttle lever fully forward and place the NOZ AIR SOV AND WIND-DOWN TEST switch as follows:

(a) OFF: Check that the thrust reverse lever cannot be engaged.

(b) At A position: Check that the blue REV caption illuminates steadily.

(c) At B position: Check that the blue REV caption remains illuminated and that the yellow WIND-DOWN caption also illuminates.

(d) At C position: Check that the yellow WIND-DOWN caption is extinguished and that the REV caption changes from steady illumination to flashing.

(4) Position the forward throttle lever to idle. Move the wind-down test switch to position B and check that the REV caption illuminates.

(5) Position the reverse throttle lever above idle and move NOZ AIR SOV AND WIND-DOWN TEST switch to OFF position. Check that the REV caption is extinguished and that WIND-DOWN caption illuminates.

(6) Move the thrust reverse lever fully down and check that WIND-DOWN caption is extinguished.

B. Air Shut-off Valve Test - Engines Running

NOTE: The 27 degrees SECURITY switches on panel 15-214 can be used to check the functionality of the 27 degrees switch within NTRC and the PIDU independently of each other, for engines 1 and 4 and/or engines 2 and 3, by selecting the TEST NTRC or TEST PIDU position. Selection of the switches to the NORM position connects the NTRC and PIDU 27 degrees switches in parallel for normal flight operation.

(1) Position the throttle lever at forward idle.

(a) Place the 27 degrees SECURITY test switch to the TEST PIDU position for engines 1 to 4.

(b) Ensure the respective test lamps are illuminated.

(c) Place the engine 1 and 4 NOZ AIR SOV AND WIND-DOWN TEST switch to position E.

(d) Check that the REV caption flashes continuously and that the WIND-DOWN caption illuminates.

(2) Position the thrust reverse lever to idle with the NOZ AIR SOV AND WIND-DOWN TEST switch still at position E. The buckets will rotate. The A.S.O.V. should close at 27 degrees stopping the buckets at approx. 35 degrees. The WIND-DOWN caption will be extinguished. If the buckets reach the 73 degrees position, this indicates failure of the PIDU/NTRC switch selected for test.

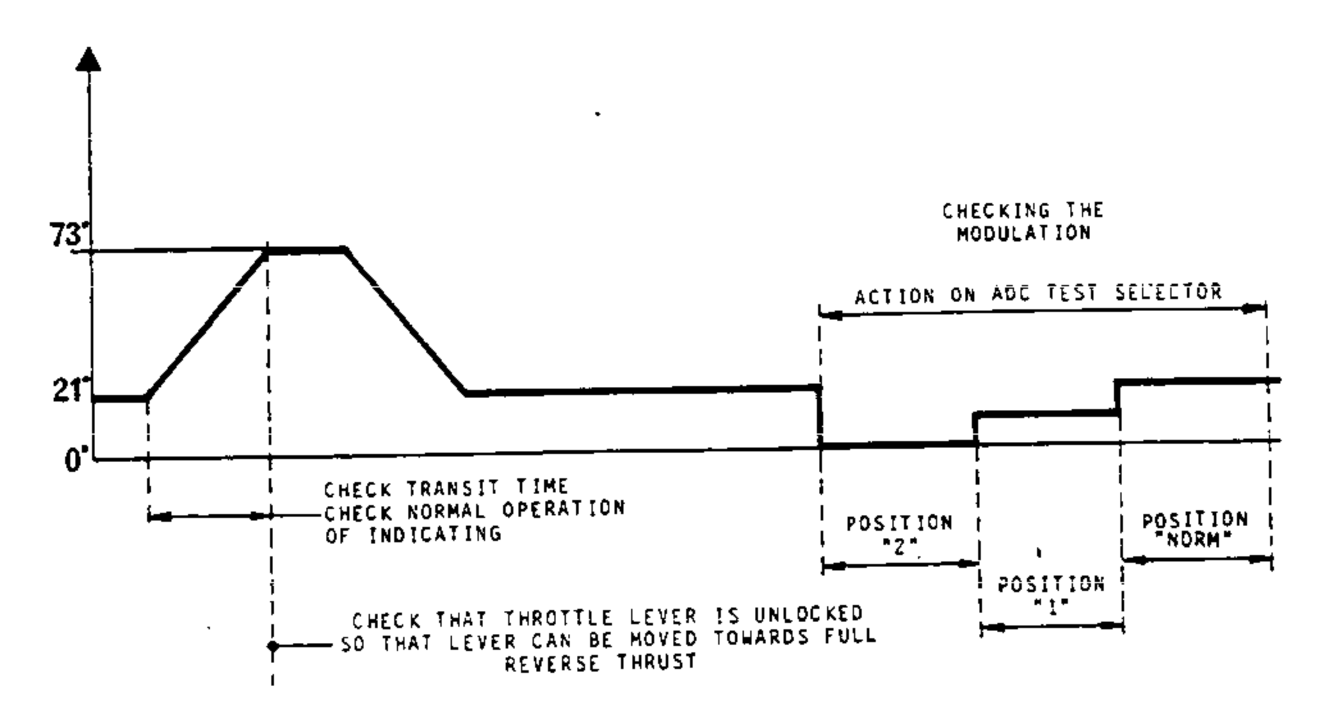
(3) With thrust reverse still selected, move the NOZ AIR SOV AND WIND-DOWN TEST switch to position D. The buckets will remain at the same position as above and the WIND-DOWN caption will illuminate.

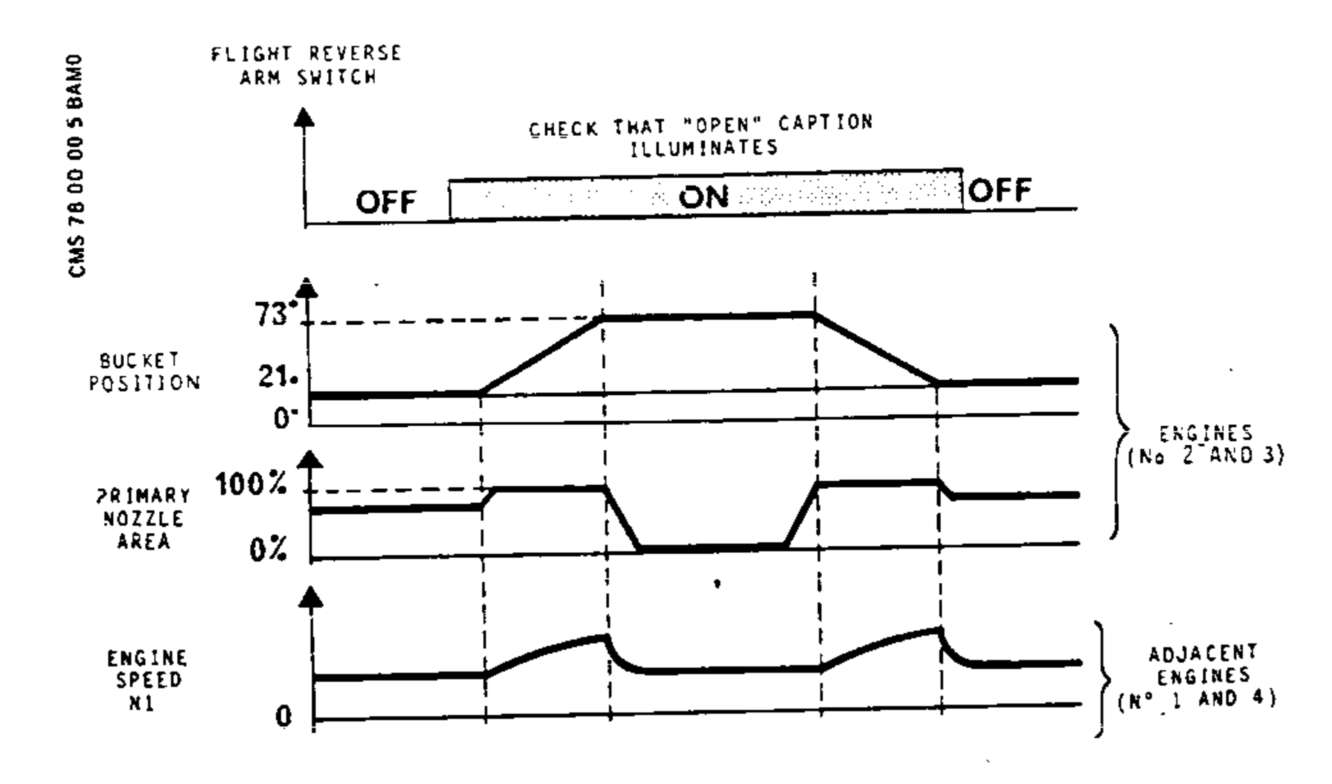
(4) Return the thrust reverse lever to forward idle and the NOZ AIR SOV AND WIND-DOWN TEST switch to OFF position. The buckets will move to 21 degrees.

(5) Repeat the checks detailed in steps B.(1)(b) to B.(4) with the 27 degrees SECURITY test switch in the TEST NTRC position.

(6) Position the 27 degrees SECURITY switch in the NORM position and ensure the test lamps are extinguished.

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Operational Test on Bucket Control
System - Engines Operating
Figure 502

C. "Reverse Thrust" then "Forward Thrust" Actuation

NOTE: This operation will be carried out only if strictly required by operating conditions or trouble-shooting. In such event, the ground run-up area must be free from any foreign matter that reverse thrust could put in motion and result in their absorption by the compressor.

(1) Actuate Reverse.

(a) Check that the "REV" caption illuminates normally; this light must flash during bucket travel and show steady illumination when buckets are at end of travel, in "Reverse Thrust" position.

(b) Check that the bucket transit time does not exceed 2.5 seconds.

NOTE: If transit time exceeds 2.5 seconds carry out measurement of drag torque over the full bucket system travel. Should be less than 0.20 daN.m (17.7 lbf.in). If satisfactory, refer to trouble shooting Chapter 71-00-51.

(c) Ensure that, at end of bucket travel, the throttle lever is unlocked and can be moved towards "Normal/Thrust reverse".

(2) Position the throttle levers back to "Idle/Forward thrust" position.

D. Crossfeed Isolation Valve Actuation

(1) Position the 4 throttle levers fully rearward in their gates with thrust reverse levers fully down.

(2) Switch on "FLIGHT REVERSE ARM". Check that "OPEN" caption illuminates and that "FLIGHT REVERSE ARM" switch remains latched in.

(3) Actuate reverse on engines No.2 and 3.

NOTE: This operation will be carried out only if strictly required by operating conditions or trouble-shooting. In such event, the ground run-up area must be free from any foreign matter that reverse thrust could put in motion and result in their absorption by the compressor.

(a) Check for N 1 speed increase on engines No. 1and 4 during bucket transit on engines No. 2 and 3 then returns to Normal Idle.

(b) Check that primary nozzles for engines No. 2 and 3 close at Aj min when buckets are in the 73 deg. position and check that "REV" caption is steady illuminated.

(c) Position the throttle levers back to "Idle/Forward thrust" position.

(4) Move any lever above 10 percent in forward thrust. Check that "OPEN" caption extinguishes.

E. Checking the Modulation

(1) Open the circuit breaker REV THRUST ASOV CONT.

(2) Depress the amber "ADC FAIL" caption and place the ADC test selector in position "2". Check that the bucket angular position observed on the SECONDARY NOZZLE indicator is within + 1 or - 1 degree.

(3) Keep depressed the amber "ADC FAIL" caption and place the ADC test selector in position "1". The bucket angular position observed on indicator must be within 16 degrees and 21 degrees.

(4) Keep depressed the amber "ADC FAIL" caption and place the ADC test selector in position "NORM". The bucket angular position observed on indicator must be within 18 deg. 30 and 23 deg. 30.

(5) Reset the REV THRUST ASOV CONT circuit breakers.

4. Functional Test

A. Equipment and Materials

	Description	Part Number	Stores Code
B	Air Start Truck	-	-
B	Extension	9970-515-296	HZAA 1623
B	NTRC Signal Measurement Box (Airesearch)	293094-1	GEES 0880

B. Preparation (Ref. Fig. 503)

R CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.

USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO DETERIORATION OF THE SCREWS.

BEFORE CARRYING OUT ANY WORK, THE SECONDARY NOZZLE MUST BE LINED WITH RUBBER CARPETS TO AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES MUST ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

(1) Remove the access panel to the upper lateral ballscrew gearbox, using a pneumatic impact wrench equipped with an appropriate screwdriver head.

(2) Remove the access cover to the ballscrew gearbox driver (Ref. Fig. 503).

(3) Ensure that bucket system circuit breakers listed in Table 501 are set.

(4) Ensure that the third crew member station NOZ AIR SOV AND WIND-DOWN test selector is in position OFF.

(5) Connect the external electrical supplies in 115 V - 400 Hz and 28 Vdc (Ref. 24-41-00 Servicing).

(6) Depress the "LIGHT TEST" push-button momentarily and check that the bucket system indicating lights illuminate normally.

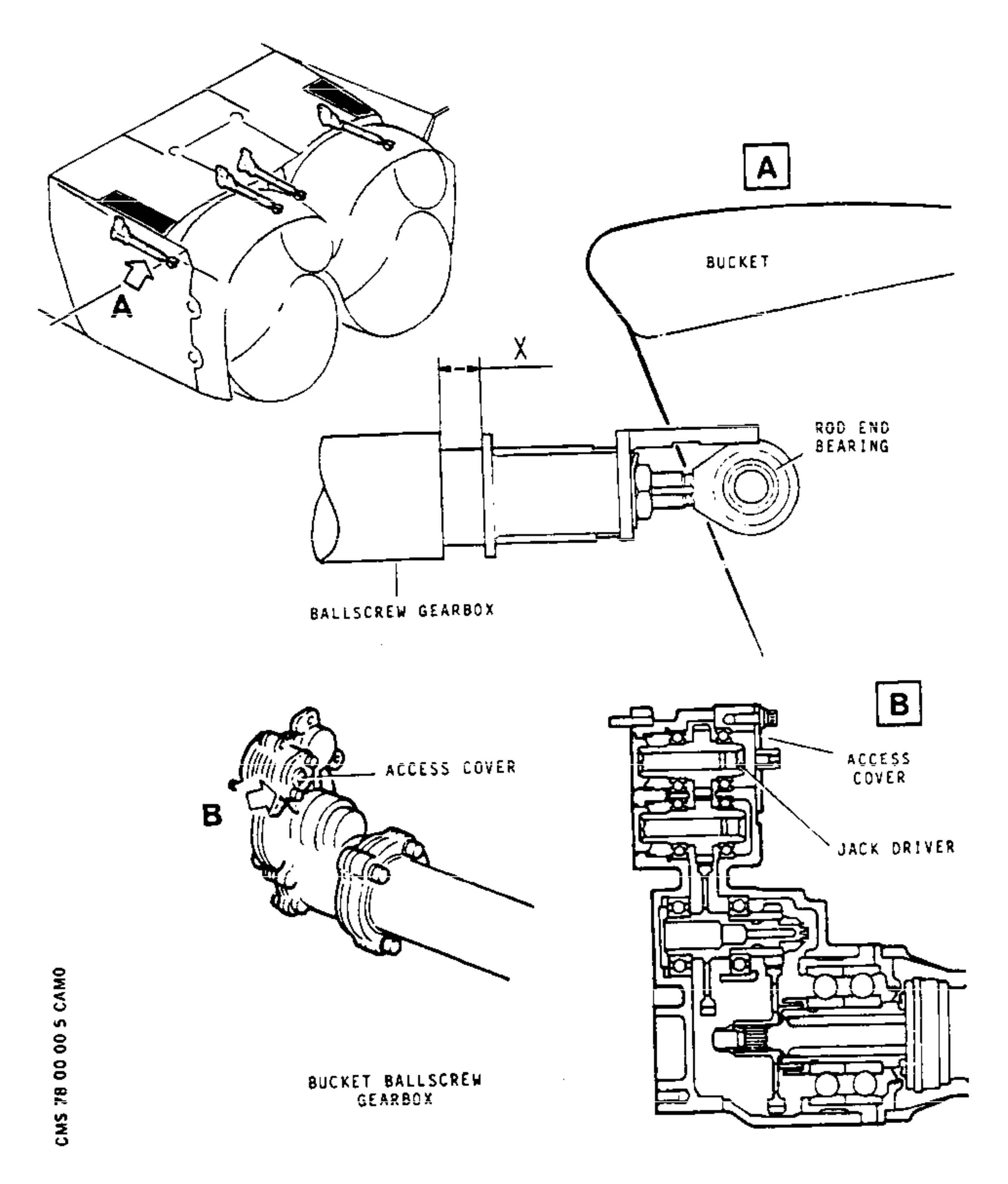
C. Static Test

(1) Make sure that the reverse throttle lever baulk prevents its moving to "Full throttle/Reverse thrust" position.

(2) Test the WIND-DOWN circuit.

(a) Position the main throttle lever to maximum thrust.

(b) Move the buckets between 45 and 50 deg. by handcranking the bucket ballscrew gearbox driver. The relevant bucket jack stroke X is within 206 and 231 mm (8.11 and 9.1 in).



Prepare to Carry Out Bucket Control System
Functional Test and Measure Bucket!
Figure 503

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(c) Set THROTTLE MASTER switch to position MAIN and check that "WIND-DOWN" caption illuminates.

(d) Move the buckets to angular position Z = 73 deg, hard against stop.

(e) Position the reverse throttle lever to normal reverse position.

B (f) Move the buckets in forward thrust direction until the "WIND-DOWN" caption illuminates.

B <u>NOTE:</u> This must occur between 6.5 and 11.5
B revolutions from the reverse position.

(3) Position the 4 throttle levers fully rearward in their gates with thrust reverse levers fully down.

R <u>WARNING:</u> AS SOON AS AIR PRESSURE IS APPLIED TO THE BUCKETS CONTROL SYSTEM, THE BUCKETS MIGHT MOVE WITHIN THE ANGULAR RANGE COMPRISED BETWEEN 0 AND 21 DEGREES. ENSURE THAT PERSONNEL OR EQUIPMENT ARE CLEAR OF THE AREA SURROUNDING THE BUCKETS.

(4) Cut and remove lockwire. Unscrew and remove the pipe closure nut from the ground test connector and connect the air pressure source to the ground test connector.

<u>NOTE:</u> The capacity of the compressed air generator will have to be such that the supply pressure measured upstream of the ground connector does not drop below 2,5 bars (36 psig) during the bucket full travel.

(5) Check for abnormal leaks that could result from faulty pneumatic connections.

(6) Check the cockpit indicating.

(a) "REV" caption extinguished.

(b) SECONDARY NOZZLE indicator between 18 deg. 30 and 23 deg. 30.

(7) Test the NASU change-over circuits.

(a) On panel 1-214, the "NOZZLE" yellow indicator light is to be initially extinguished.

(b) On panel 1-214, place momentarily the test change-over switch successively on "NASU 1" then on "NASU 2".

(c) The "NOZZLE" caption light must illuminate during actuation of the change-over switch.

(8) Install the access cover to the bucket ballscrew gearbox driver and torque-tighten the two bolts to 0.30 daNm (25 lbf in).

R CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD. USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

(9) Install the access panel to the ballscrew gearbox and torque the fitting screws to 0.60 daNm (53 lbf in) using a pneumatic vibration screwdriver pre-adjusted at the required torquing value and equipped with an appropriate screwdriver head.

D. Checking the "Forward Thrust/Reverse Thrust" motions (Ref. Fig. 504 and 505).

(1) Pull the thrust reverse lever to the intermediate baulk and observe buckets and indicators.

(a) Make sure that the buckets travel smoothly.

(b) Make sure that travel time does not exceed 2.5 seconds.

NOTE: If transit time exceeds 2.5 seconds, carry out measurement of drag torque over the full bucket system travel. Should be less than 0.20 daNm (17.7 lbf in). If satisfactory, refer to trouble-shooting Chapter 71-00-51. (Engine Bay No. 2 or 3).

(c) Make sure that the indicating operates correctly.

(i) Flashing of the "REV' Caption during travel.

(ii) "REV" caption steady illuminated at the end of travel.

(d) At end of run, check that the throttle lever is unlocked and can be placed in "Normal throttle/ Thrust reverse" position.

MAINTENANCE PRACTICE REFERENCE	C (1)	C (2) (a c)	C (2) (d-e)	C (2) (f-g)	C (3)
AIR PRESSURE	NO PRESSURE				
OPERATION	CHECK REVERSE BAULK	CHECK THAT 'WIND DOWN' CAPTION ILLUMINATES			CONCLUSION OF OPERATION
THROTTLE LEVER POSITION	ATTEMPT POSITIONING ON 'NORMAL THROTTLE/REVERSE THRUST'	FORWARD THRUST/ MAXIMUM THRUST	NORMAL REVERSE	NORMAL REVERSE	4 THROTTLE LEVERS FULLY REARWARD/ THRUST REVERSE LEVERS FULLY DOWN
THEORECTICAL BUCKET POSITION Z	21 DEG	45 DEG	73 DEG	MOVE BUCKETS IN FORWARD THRUST DIRECTION BY ROTATING BUCKET BALLSCREW DRIVER 9 REVOLUTIONS	
BUCKET JACK STROKE X	76 TO 96mm	204 TO 208mm			

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Test of Wind-Down Circuit (Engine Bay 2 or 3)
Figure 504

MAINTENANCE PRACTICE REFERENCE	C (4-5)	C (6-7)	D (1)	D (2)	D (3-4-5)
AIR PRESSURE		3 BARS		NO PRESSURE	3 BARS
OPERATION		CHECK INDICATING AND NASU CHANGE OVER	MEASURE TRANSIT TIME OBSERVE SECONDARY NOZZLE INDICATOR CHECK THROTTLE LEVER UNLOCKING	CHECK IMPOSSIBILITY FOR LEVER TO REACH FULL THROTTLE/ FORWARD THRUST	MEASURE TRANSIT TIME OBSERVE POSITION INDICATOR CHECK THROTTLE LEVER UNLOCKING
THROTTLE LEVER POSITION	FORWARD THRUST/ IDLE		NORMAL THROTTLE/ THRUST REVERSE	ATTEMPT POSITIONING LEVER ON FULL THROTTLE/FORWARD THRUST	FORWARD BAULK
THEORETICAL BUCKET POSITION Z	21 DEG	21 DEG	21 TO 73 DEG	73 DEG	73 TO 21 DEG
BUCKET JACK STROKE X	76 TO 96 mm	76 TO 96 mm			

CHECKING THIS BAY

AIR SUPPLY

CMS 78 00 00 5 EAMO

Check of the 'Forward Thrust/Reverse Thrust
(Engine Bay No.2 or 3)
Figure 505

(2) Disconnect the air source and check that the throttle lever baulk prevents its moving to "Full throttle/ Forward thrust".

(3) Reconnect the air source.

(4) Position the thrust reverse lever down in the forward baulk position and observe the buckets and indicator.

(a) Make sure that the buckets travel smoothly.

(b) Make sure that travel time does not exceed 2.5 seconds.

(c) Make sure that the indicator operates correctly.

(5) Check that, at end of run the throttle lever is unlocked and can be placed in the Full throttle/ Forward thrust position.

R E. Checking the Air Shut-off Valve (A.S.O.V.) Closing (Ref.
R Fig. 506).

R NOTE: The 27° SECURITY test switches on panel 15-214 can
R be used to check the functionality of the 27°
R switch within NTRC and the PIDU independently of
R each other, for engines 1 and 4 and/or engines 2
R and 3, by selecting the TEST NTRC or TEST PIDU
R position. Selection of the switches to the NORM
R position connects the NTRC and PIDU 27° switches
R in parallel for normal flight operation.

R (1) Checking A.S.O.V. closing by NTRC 27° relay signal.

R (a) Position the 27° SECURITY test switch to the
R TEST NTRC position.

R (b) Ensure the test lamps are illuminated.

(c) Set the NOZ AIR SOV AND WIND-DOWN TEST switch to position E.

(d) Position the four throttle levers fully rearward in their gates with the thrust reverse levers fully down.

(e) Connect the 3 bar (43 psig) compressed air source to the ground connector.

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(f) Position the thrust reverse lever to reverse idle. The buckets must rotate and the A.S.O.V. must close at 27°. The buckets must stop before 35°. The relevant bucket jack stroke must be less than 155 mm (6.10 in).

(g) Place the NOZ AIR SOV AND WIND-DOWN TEST selector to OFF position.

NOTE: As soon as the selector is positioned to OFF the A.S.O.V. is no longer actuated in the closing position. The buckets rotate towards the 73° position.

(h) Push the thrust reverse lever downwards, bearing on the forward baulk.

(i) Check on the SECONDARY NOZZLE graduated indicator of 3rd crew member's panel that the buckets have returned to 21 ± 3°.

(j) Push the thrust reverse lever fully downward.

R (k) Place the 27° SECURITY test switch in the NORM
R position and ensure the test lamps are extinguished.

R (l) Disconnect the compressed air supply from the ground test connector.

(2) Checking A.S.O.V. closing by bucket position transmitter 27° SW4 switch.

(a) Position the four throttle levers fully rearward in their gates with the thrust reverse levers fully down.

R (b) Connect the 3 bar (43 psig) compressed air source
R to the ground connector.

R (c) Place the 27° SECURITY test switch to the TEST
R PIDU position.

R (d) Ensure the test lamps are illuminated

R (e) Place the NOZ AIR SOV AND WIND-DOWN TEST switch
R to E position.

R (f) Position the thrust reverse lever to reverse
R idle. The buckets must rotate and the A.S.O.V.
R must close at 27°. The buckets must stop before
R 35°. The relevant bucket jack stroke must be
R less than 155 mm (6.10 in).

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(g) Place the NOZ AIR SOV AND WIND-DOWN TEST selector to OFF position.

NOTE: As soon as the selector is positioned to OFF the A.S.O.V. is no longer actuated in the closing position. The buckets rotate towards the 73° position.

(h) Place the 27° SECURITY test switch in the NORM position and ensure the test lamps are extinguished.

(i) Push the thrust reverse lever downwards, bearing on the forward baulk.

(j) Check on the SECONDARY NOZZLE graduated indicator of 3rd crew member's panel that the buckets have returned to 21 ± 3°.

(k) Push the thrust reverse lever fully downward.

(l) Disconnect the compressed air supply from the ground test connector.

(3) Checking A.S.O.V. closing by the NASU Mach 1.2 signal.

(a) Connect the AIRESEARCH NTRC signal measurement box No. 293 094-1 to the NTRC J2 connector.

(b) Position the four throttle levers fully rearward in their gates with the thrust reverse levers fully down.

(c) Position the measurement box DC signal selector to A.S.O.V. and check that the voltage is 0 volt.

(d) Set the 3rd crew member ADC test selector in position 2 and check that A.S.O.V. voltage is 28 V approx.

(e) Reset the DC signal selector to OFF.

(f) Reset the ADC test selector to NORM.

(g) Disconnect the NTRC signal measurement box from the NTRC.

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(h) Refit access panels 215 AS and 216 GS.

NOTE: Operations of the A.S.O.V. can be verified by checking the A.S.O.V. air leaks through drive actuator exhaust elbow. For this purpose, connect a 3 bar (43 psig) compressed air source to the ground connector. When the A.S.O.V. is open, air leaks are easily detected. When the A.S.O.V. is closed, air leaks are null. An audio check is usually sufficient.

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MAINTENANCE PRACTICE REFERENCE	E (1 TO 3)	F (1)	F (2)	F (3)
AIR PRESSURE	3 BARS			
OPERATION	CHECK A.S.O.V. CLOSING BY SIGNALS FROM : - NTRC (BCU) 27 DEG RELAY Ref. Ope. E (1) - BUCKET POSITION TRANSMITTER (INDICATOR) SWITCH SW4. Ref. Ope. E (2) - NASU (MACH > 1.2 SIGNAL) Ref. Ope. E (3)	PLACE ADC TEST SW IN POSITION "2"	PLACE ADC TEST SW IN POSITION "1"	PLACE ADC TEST SW IN POSITION "NORM"
THROTTLE LEVER POSITION		FULL THROTTLE/ FORWARD THRUST	FULL THROTTLE/ FORWARD THRUST	FULL THROTTLE/ FORWARD THRUST
THEORETICAL BUCKET POSITION Z		0 DEG	18°30'	21 DEG
BUCKET JACK STROKE X		0 mm	65 TO 84 mm	76 TO 96 mm

CHECKING THIS BAY

AIR SUPPLY

CMS 78 00 00 5 FAMO

Check of the Modulation and A.S.O.V. on Engine Bay No. 2 or 3
Figure 506

F. Checking the Modulation

(1) Pace the ADC test selector in position "2". The Mach simulation corresponds to M = 2.

(a) Check that buckets are at 0 deg. by checking that the bucket jack stroke X is 0 mm.

B NOTE: Refer to Chapter 71-00-13, Trouble-Shooting
B if buckets fail to modulate to 0 deg.

(b) Check that the bucket angular position observed on the SECONDARY NOZZLE indicator is within + 1 and - 1 degree.

(2) Depress the amber "ADC FAIL" caption and place the ADC test selector in position "1". The Mach simulation corresponds to M = 0.63.

(a) Disconnect the compressed air supply.

(b) Check that bucket jack stroke X is within 65 and 84 mm (2.56 and 3.31 in.).

(c) Check that the bucket angular position observed on the SECONDARY NOZZLE indicator is within 16 and 21 degrees.

(d) Reconnect the compressed air supply.

(3) Depress the amber "ADC FAIL" caption and place the ADC test selector in position "NORM".

(a) Disconnect the compressed air supply.

(b) Check that bucket jack stroke X is within 76 and 96 mm (2.99 and 3.78 in.).

(c) Check that the bucket angular position observed on the SECONDARY NOZZLE indicator is within 18 deg. 30 and 23 deg. 30.

G. Checking the Bucket System of the Adjacent Bay.

(1) Connect the compressed air supply to adjacent bay ground test connector.

(2) Carry out on this bay all the checks listed in paragraphs D through F.

MAINTENANCE PRACTICE REFERENCE	G	H(1)	H(2)(a-b-c)	H(2)(d)	H(2)(f-g)	I
AIR PRESSURE	3 BARS					0
OPERATION	CONNECT COMPRESSED AIR SUPPLY TO ADJACENT BAY GROUND CONNECTOR AND REPEAT ALL THE PREVIOUS CHECKS.	OPEN UP ADJACENT BAY GROUND CONNECTOR AND CHECK FOR LEAKS THEN REBLANK.	OPERATE FLIGHT REVERSE ARM SWITCH CHECK THAT OPEN CAPTION ILLUMINATES.	PERFORM A REVERSE THRUST/ FORWARD THRUST OPERATION ON ADJACENT BAY AND CHECK FOR TRAVEL TIME.	POSITION ANY THROTTLE LEVER FULLY FORWARD AND CHECK THAT "FLIGHT REVERSE ARM" SWITCH IS UNLATCHED. "OPEN" CAPTION IS EXTINGUISHED.	REPEAT ON ADJACENT BAY THE TEST ON WIND-DOWN CIRCUIT AS DESCRIBED IN PARA. C (2)
THROTTLE LEVER		PLACE THE FOUR THROTTLE LEVERS FULLY REARWARD WITH REVERSE LEVERS FULLY DOWN.	IDLE/FORWARD THRUST.	IDLE/REVERSE THRUST THEN IDLE/FORWARD THRUST.		
THEORETICAL BUCKET POSITION Z						
BUCKET JACK STROKE X						

Check of Crossfeed Isolation Valve
Figure 507

H. Crossfeed Isolation Valve Test (Ref. Fig.507).

(1) Valve in "Closed" position.

(a) Open up the adjacent bay ground test connector.

(b) Check for leaks.

(c) Re-blank the ground test connector.

(2) Valve in "Open" position.

(a) Position the four throttle levers fully rearward in their gates with thrust reverse levers fully down.

(b) Switch on "FLIGHT REVERSE ARM" switch.

(c) Ensure that "OPEN" caption lights up.

(d) Carry out on the adjacent bay a "Forward thrust/Reverse thrust" operation and check that travel time is comprised between 2 and 3.5 seconds.

(e) Return the buckets to the "Forward thrust" position.

(f) Position any throttle lever fully forward and check that "FLIGHT REVERSE ARM" switch is unlatched. The "OPEN" caption is extinguished.

(g) Check by selecting the thrust reverse that this operation has no effect: the buckets do not move.

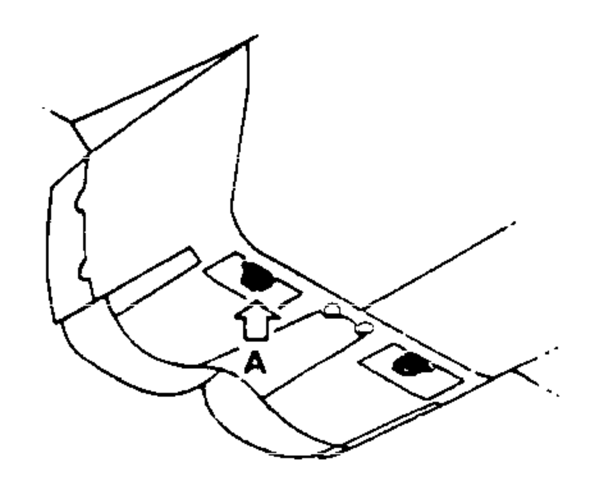
I. Testing the WIND-DOWN Circuit of the Adjacent Bay

(1) Disconnect the air supply hose from the ground test connector.

R CAUTION: FAILURE TO CORRECTLY REPLACE AND SECURE THE PIPE CLOSURE NUT COULD RESULT IN HOT AIR LEAKAGE WITH CONSEQUENT DAMAGE TO ADJACENT WIRING LOOMS AND COMPONENTS.

(2) Re-blank the ground test connector; torque the pipe closure nut to 3.5 daNm (25.81 lb.ft) and lockwire (Ref.20-21-13).

(3) Carry out the test prescribed in paragraph C, operations (2), (5), (6), (8), (9).



CONNECTOR I

A

BUCKET POSITION
TRANSMITTER (INDICATOR)

FLIGHT DIRECTION

CMS 78 00 00 5 HAMO

Preparation for the 27 deg Relay Operational
Test of NTRC
Figure 508

COLLECTOR/NOZZLE - DESCRIPTION AND OPERATION

1. Reheat Jet Pipe

A. General

The reheat jet pipe directs gases from the turbine towards the primary nozzle. It is in this chamber that the fuel which is injected during the reheat operation is burnt.

B. Description (Ref. Fig. 001)

The three main elements making up the reheat jet pipe are the reheat duct, the anti-screech liner and the ventilation shroud. The reheat duct forms the main part. The anti-screech liner located in its front part reduces the importance of vibratory phenomena through the combined action of its corrugation and relief holes.

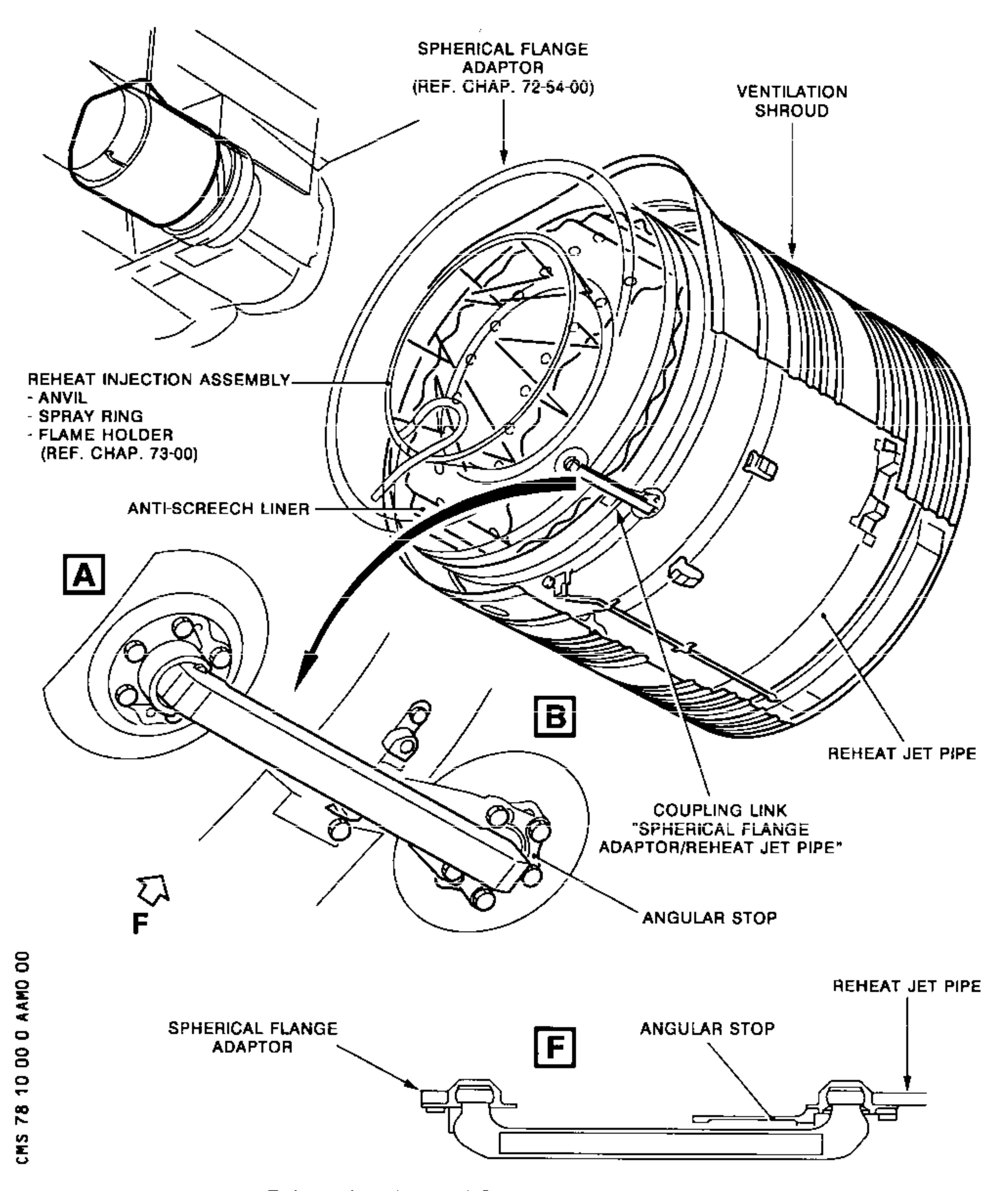
The ventialtion shroud which surrounds the duct protects nacelle and wing from heat radiation. The thermal insulation of this shroud is increased in its upper part, by an insulating layer made up from quartz wool between two sheets of corrugated stainless steel.

To avoid any mechanical instability, the rear part of the duct is slightly conical in shape. In operation, this provides a force which tends to push the reheat jet pipe to the rear. A coupling link connects the spherical flange adaptor fitted on the rear flange of the basic engine and the reheat jet pipe. It bears the traction of the reheat jet pipe we have just mentioned, and insures its longitudinal immobilization.

Details A and B (Ref. Fig. 001) show how the reheat jet pipe is immobilised longitudinally and in rotation in relation to the spherical flange adaptor: the angular stop attached to the reheat duct prevents rotation by contact with two bosses on the spherical flange adaptor.

The rear flange of the reheat duct is surrounded by a deflector the role of which is to reject to the rear the gas leaks from the "jet pipe/primary nozzle" joint. Any leaks that may occur, such as those due to a false start are collected by a pipe connected to the deflector. Drainage is also effected from the leak recovery device located in the plane of joint of the spherical flange adaptor and the front flange of the reheat duct.

R
2. Primary Nozzle



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R

Reheat Jet pipe and Spherical Flange Adaptor
Figure 001

A. General

To ensure optimum engine performance under all operating conditions, a variable geometry primary nozzle is fitted to each engine as an extension of the reheat jet pipe. The nozzle aperture is at maximum during reheat operation, and at minimum during reverse thrust. For normal operation the nozzle aperture is somewhere between maximum and minimum operational area (Ref. Chap. 76). The position of the primary nozzle petals is automatically controlled by an electronic unit to suit any given power setting or thrust mode, and is interconnected with the air intake control system to ensure that corrections are made to the nozzle aperture to compensate for variations in pressure within the air intake (Ref. Chap. 71).

The degree of opening of the petals, which form the primary nozzle, determines the area of the orifice so obtained. This information is monitored by a primary nozzle mounted detector unit, from which an electrical signal is taken to the AREA (AJ) indicator on the pilot's dashboard centre instrument panel. The AJ indicator forms part of the power plant configuration indication circuit, in reverse thrust (Ref. 77-13-00).

B. Description (Ref. Fig. 002)

(1) The primary nozzle is attached by three pins to the twin secondary nozzle assembly.

The main elements making up the primary nozzle are the convergent section, the mounting duct and 36 petals (18 controlled, 18 followers) acctuated by 18 pneumatic jacks. The convergent section is a duct the front flange of which accommodates the rear flange of the reheat duct and directs the gases from there to the petals. The mounting duct is slotted and includes a mounting ring at the front end. On the mounting ring are fitted the three mounting pin spherical bearings and all the pneumatic jack front rod end bearings.

A static pressure tapping is located at the rear upper part of the primary nozzle convergent section. This pressure is conveyed to the reheat detection pressure-switch secured to the nacelle.

The primary nozzle area is an important parameter for basic engine adjustment. As such, it interests the pilot; a nozzle area indicator
is located on the pilots centre dash panel. For these reasons one lower petal is fitted with a link

PNEUMATIC REHEAT DETECTION
STATIC PRESSURE TAPPING AND PIPE

PRIMARY NOZZLE
MOUNTING PINS
IN TWIN SECONDARY
NOZZLE

CONVERGENT
SECTION

MOUNTING PIN
SPHERICAL BEARINGS

FRONT NOZZLE
FAIRING

PRIMARY NOZZLE
AREA TRANSDUCER

JACK AIR MANIFOLD

FRONT NOZZLE
FAIRING

REHEAT JET PIPE

CONVERGENT
SECTION

MOUNTING
RING

JACK

PETAL

CMS 78 10 00 0 DAMO

Primary Nozzle
Figure 002

R

connected to the nozzle area transducer attached on the nozzle mounting ring as shown in the illustration. (Ref. Fig. 003)

(2) Primary Nozzle Area (AJ) Indicator (Ref. Fig. 004)

The AJ indicator is a servo-operated instrument that presents the position of the variable primary nozzle as a percentage of the normal (maximum to minimum) operational area. The instrument presentation consists of a pointer rotating about a dial graduated from 0 or 120 per cent. Delimitation of the reheat operating sector is indicated by a white sector on the outside of the dial with addition of a yellow sector on Engine 4 AJ indicator to take care of the power limitation applied to this engine during the early phase of the take-off run (limitation up to 60 knots). An internal pre-set differential switch, and and associated change-over relay, operate when the indicator reading is 15 per cent or less, during reverse thrust operation. A red and black diagonally striped failure warning flag is displayed in a cut-out in the dial if there is a power supply failure, an open-circuit condition in the input signal circuit, or failure of the instrument servo-system.

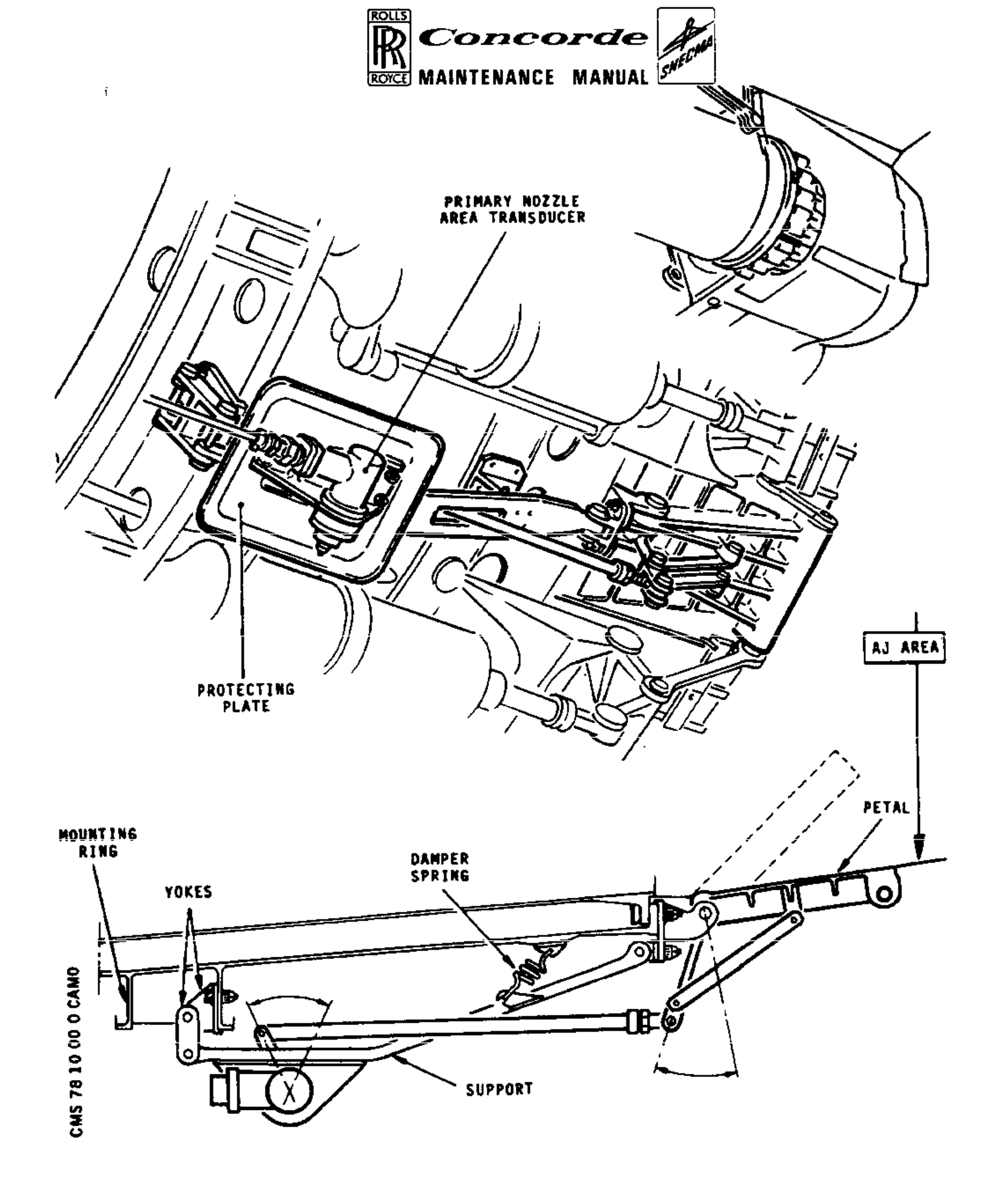
An additional potentiometer within each instrument provides an ouput to the aircraft flight data recorder.

Power supplies for the Nos. 1, 2, 3 and 4 indicators are taken from the associated (1, 2, 3 or 4) main 115 V a.c. busbars.

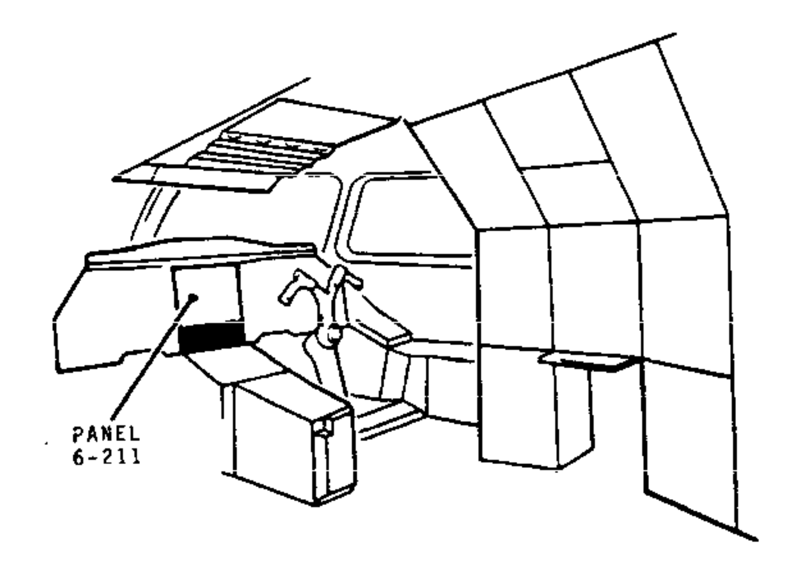
C. Operation (Ref. Fig. 005)

The primary nozzle is controlled by air from the P.N.C. (Pneumatic Nozzle Control Unit) located in the nacelle. The illustration (Ref. Fig. 005) shows the action of the jacks on the petals. Each jack is coupled to the adjacent petals controlled through connecting rods and levers. It can be seen that the control device itself synchronises the movement of the petals.

When an engine is running, the primary nozzle is controlled by the power control circuit to form a suitably-sized orifice for the prevailing circumstances. Signals from the associated detector unit are processed by the AREA indica-



Primary Nozzle Area Detection System
Figure 003



AJ INDICATORS

CMS 78 10 00 0 DAMO

Primary Nozzle Area Indicators
Figure 004

R

FOLLOWER PETAL

CONTROLLED PETALS

PRIMARY NOZZLE JACK

CMS 78 10 00 0 EAMO

Primary Nozzle Petal Kinematic
Figure 005

tor, and displayed as a percentage of the variable area of the nozzle, with the pointer moving to follow any change in nozzle configuration.

During reverse thrust operation the primary nozzle is automatically selected to the minimum orifice position (AJ min). When this position is attained the AREA pointer displays less than 15 per cent and the differential switch and associated relay operate to interrupt the circuit to the CON caption, which remains unlit. In the event of the primary nozzle not closing when reverse thrust is selected, the CON caption circuit is armed through the indicator switching and the caption is illuminated, to signal a configuration fault to the pilot (Ref. 77-13-00). For in-flight reverse thrust only, the primary nozzle is controlled to AJ max. (Ref. Chap. 76) during transit, to reduce the bucket hinge movements; AJ min. is still used when the reverse setting has been achieved.

REHEAT JET PIPE - REMOVAL/INSTALLATION

1. General

This topic details the removal/installation of the reheat jet pipe, basic engine installed or removed from aircraft.

2. Reheat Jet Pipe, Basic Engine Installed

A. Equipment and Materials

	DESCRIPTION	PART NO.
R	Mini-lift (250kg-5cwt) fitted with	
R	1.220 mm (48 in.) extension (2 off).	-
	Suspension cord	E.93.5014.000
	Top sheath unit	E.93.5015.000
	Sling	E.93.5013.000
	Jet pipe cradle	E.93.5002.000
	Jet pipe support beams	
	- front beam :	E.93.5003.000
	- rear beam :	E.93.5003.001
	Support frame	E.93.5004.000
	Jet pipe upper jacking structure	E.93.5016.000
	Jet pipe lower jacking structure	E.93.5017.000
R	Extractor/Inserter, short, nozzle	
R	mounting pin	E.92.5003.001
R	Extractor/Inserter, long, nozzle	
R	mounting pin	E.92.5003.000
R	Locating tool, short, nozzle	
R	support attachment	E.92.5004.001
R	Locating tool, long, nozzle support	
R	attachment (2 off)	E.92.5004.002
R	31 tooth wrench	9970.515.056
	37 tooth wrench	9970.515.062
R	7/16 in. hexagon headed wrench	-
R	5 in. extension	-
	Torque wrench (0 to 3 daN.m range)	-
	Circuit breaker safety clips	-

B. Prepare to Remove Reheat Jet Pipe
(Ref. Fig.401 and 402)
(Ref. Fig.403 and 404)

(1) Obtain access to the reheat jet pipe by opening engine bay rear door. (Ref. 71-00-00, Servicing).

(2) Electrically isolate the engine and exhaust assembly services indicated in Table 401 by tripping the circuit breakers affecting engines in the nacelle upon which work is being carried out. Fit circuit breaker

safety clips.

(3) Display a suitable placard on the engine starting panel indicating that personnel are working on the engines and in the twin secondary nozzle area.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	ENGINE No. 1			
	MAIN THROT SUP	2-213	1K1	F12
	ENG 1 % AREA (AJ) IND	14-215	1E81	C13
	ENG VIBRATION IND SUP 1	4-213	E512	C18
	ENG VIBRATION IND SUP 2	4-213	E513	D18
R	REHEAT CONT.	15-216	1K1542	E 9
R	REHEAT AMP. SUP.	14-215	1K1541	C12
	ENGINE No. 2			
	MAIN THROT SUP	2-213	2K1	C12
	ENG 2 % AREA (AJ) IND	13-215	2E81	D13
	ENG VIBRATION IND SUP 1	4-213	E512	C18
	ENG VIBRATION IND SUP 2	4-213	E513	D18
R	REHEAT CONT.	15-215	2K1542	D15
R	REHEAT AMP. SUP.	13-215	2K1541	B14
	ENGINE No. 3			
	MAIN THROT SUP	2-213	3K1	C13
	ENG 3 % AREA (AJ) IND	13-216	3E81	B 6
	ENG VIBRATION IND SUP 1	4-213	E512	C18
	ENG VIBRATION IND SUP 2	4-213	E513	D18
R	REHEAT CONT.	15-215	3K1542	D16
R	REHEAT AMP. SUP.	13-216	3K1541	B 7
	ENGINE No. 4			
	MAIN THROT SUP	2-213	4K1	F13
	ENG 4 % AREA (AJ) IND	14-216	4E81	B 6
	ENG VIBRATION IND SUP 1	4-213	E512	C18
	ENG VIBRATION IND SUP 2	4-213	E513	D18
R	REHEAT CONT.	15-216	4K1542	E10
R	REHEAT AMP. SUP.	14-216	4K1541	D 7

Circuit Breakers
Table 401

(4) Remove the Primary Nozzle Control Assembly Trim Unit (N.C.T.U) and the Primary Nozzle Control Assembly Pneumatic Valve P.N.C from the nacelle wall (Ref. 76-13-21).

(5) Disconnect the primary nozzle area transducer electrical cable.

(6) Disconnect the reheat pneumatic detection flexible pipe.

(7) Disconnect the reheat jet pipe fuel drainage tube coming from the rear flange.

(8) Disconnect the primary nozzle jacks air supply pipe.

(9) Remove the spherical joint box from the spherical joint adaptor.

CAUTION: EXTRACT THE SPHERICAL JOINT BOX USING ITS THREADED HOLES AND APPROPRIATE SCREWS.

(10) Attach the upper jacking structure on the primary nozzle.

(11) Position the lower jacking structure then adjust the jacks to take the weight of the primary nozzle.

(12) Position the reheat jet pipe cradle on the reheat jet pipe.

(13) Remove the access door to the buckets position transmitter (indicator) located at the lower part of the twin secondary nozzle.

(14) Attach the support frame on the secondary nozzle.

(15) Adjust the jet pipe support ball casters position so as to take the weight of the reheat jet pipe.

(16) Remove the primary nozzle mounting pins access covers.

R CAUTION: BEFORE CARRYING OUT ANY WORK, THE SECONDARY
R NOZZLE MUST BE LINED WITH RUBBER CARPETS TO
R AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS
R OR SCRATCHES. A LIGHT PAIR OF SHOES MUST
R ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

(17) Remove each of the nozzle mounting pins (Ref. Fig. 403).

PRIMARY NOZZLE

STEP 1
PRIMARY NOZZLE UPPER
AND LOWER JACKING
STRUCTURES INSTALLATION

JACKING SCREWS

STEP 2
BACKING OF THE
PRIMARY NOZZLE

REHEAT
JET PIPE

A

PRIMARY NOZZLE UPPER
AND LOWER JACKING
STRUCTURES

A

CMS 78 11 01 4 AAMO

Prepare to Remove Reheat Jet Pipe
Figure 401

R

A

B

C

D

A

P3 AIR
FROM PNC

AIR SUPPLY PIPE
PRIMARY NOZZLE JACK

C

REHEAT JET PIPE
FUEL DRAINAGE TUBE
COMING FROM REAR FLANGE

D

SUPPLY PRESSURE
APPLIED TO REHEAT
DETECTION PRESSURE
SWITCH

B

REHEAT PNEUMATIC
DETECTION PIPE

PRIMARY NOZZLE AREA
TRANSDUCER CONNECTOR

CMS 78 11 01 4 BAM0

Prepare to Remove Reheat Jet Pipe
Figure 402

A

A

TWIN SECONDARY NOZZLE

MOUNTING PIN

B

PLATE

SPLIT PIN

SPHERICAL STOP

CROSS FITTING

LOCK

SPACER

B

SCREW

CMS 78 11 01 4 CAMO

COVER

COVER RETAINING SCREW

Primary Nozzle Mounting Pin Assembly
Upper or Lower Pin
Figure 403

FRONT SUSPENSION LINK

F

JET PIPE SUPPORT CRADLE

SPHERICAL JOINT BOX

SUPPORT FRAME

ANTI-ROLL BOX

F

TOP SHEATH UNIT ON NACELLE WALL

F_1

MINI-LIFT EXTENSION

SLINGS

F_1

SUSPENSION CORD

FRONT HOISTING BAR - BEAM

SUPPORT FRAME

MINI-LIFT

REAR HOISTING BAR - BEAM

CMS 78 11 01 4 DAM0

Reheat Jet Pipe Removal, Basic Engine Installed
Figure 404

R (a) Remove the spacers.

NOTE: The side mounting pins are not fitted with spacers.

(b) Remove the split pins from the locks.

(c) Remove the locks.

(d) Unscrew the spherical stops and remove the cross-fittings.

(e) Remove the plates.

(f) Using the appropriate extractor/inserter tool remove each mounting pin in turn.

NOTE: For the upper and lower pins, use the long extractor. For the pin accessible via the side wall, use the short extractor.

(18) Push back the primary nozzle by hand up to the rear stop position.

(19) Attach the front and rear hoisting beams on reheat jet pipe cradle.

(20) Position the hoist suspension cord on the engine access door.

(21) Attach the hoist on the suspension cord.

(22) Attach the second hoist on the top sheath unit fitted on the nacelle wall.

(23) Hook the slings to the jet pipe support hoisting beams and to the ends of the hoist cables.

C. Remove Reheat Jet Pipe (Ref. Fig. 404).

(1) Operate the hoists so as to support the reheat jet pipe weight.

(2) Remove the jet pipe support frame.

(3) Actuate both hoists simultaneously to lower the reheat jet pipe.

CAUTION: GUIDE THE JET PIPE VERY CAREFULLY AND MAKE SURE THAT IT DOES NOT CONTACT ANY OF THE NACELLE EQUIPMENT DURING THIS OPERATION.

D. Prepare to Install Reheat Jet Pipe (Ref. Fig.401 and 404).

NOTE: It is assumed that the hoists placed for the removal are still in place and that the primary nozzle is in the "against rear stops" position as indicated in paragraph. B(20).

(1) Smear all liaison parts of the primary nozzle mounting pins with lubricant S (Ref.70-00-01).

R (2) Smear plate, spherical stop and cross-fitting with
R lubricant J (Ref. 70-00-01).

(3) The reheat jet pipe being on its container base, fit it with reheat jet pipe cradle front and rear hoisting beams.

(4) Bring the reheat jet pipe into it's horizontal position and let it rest on its support.

(5) Connect the slings to the front and rear reheat jet pipe cradle hoisting beams.

E. Install Reheat Jet Pipe (Ref. Fig.401 and 404).

CAUTION: BEFORE CARRYING OUT ANY WORK, THE SECONDARY NOZZLE MUST BE LINED WITH RUBBER CARPETS TO AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES MUST ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

(1) Actuate both hoists simultaneously to raise the reheat chamber.

CAUTION: GUIDE THE JET PIPE VERY CAREFULLY AND MAKE SURE THAT IT DOES NOT CONTACT ANY OF THE NACELLE EQUIPMENT DURING THIS OPERATION.

(2) Install the jet pipe support frame.

(3) Slacken the cables of the two hoists and allow the reheat jet pipe weight to rest on the reheat jet pipe support frame, disconnect the slings from the hoisting beams and remove both hoists.

(4) Screw or unscrew the jet pipe cardle ball casters so as to line-up the reheat jet pipe flange and the spherical flange adaptor.

(5) Move the primary nozzle toward the front so that the reheat jet pipe rear flange penetrates in the primary

nozzle front flange.

NOTE: Screw or unscrew the jet pipe cradle ball casters feet so as to give the alignment of the two flanges, the finishing touch.

(6) Position and retain the primary nozzle in the secondary nozzle by inserting the mounting pin locating tools, one at a time in the order, lower-upper-side. Each tool must be fully engaged with the locking pins in and the probe free to rotate.

NOTE: At the lower and upper attachments, use the long locating tools, at the attachment accessible via the sidewall, insert the short locating tool.

(7) Remove each locating tool in turn (in the same order as above) and replace it with a primary nozzle mounting pin, using the appropriate long or short extractor inserter tool (Ref. Fig. 403).

(a) Screw the spherical stop fully into the cross-fitting.

(b) Position the plate in the pin.

(c) Position the cross-fitting and lock it in position.

R (d) Screw up the spherical stop to eliminate play.

(e) Make sure that all parts are correctly positioned.

(f) Torque the spherical stop to 2,5 daN.m (18.4 lbf.ft) then slacken.

(g) Torque the spherical stop to final value:

(i) First to 1,30 daN.m (115 lbf.in).

(ii) Try to position the lock on the cross-fitting.

(iii) If assembly is not possible, tighten the spherical stop further until the lock apertures line-up with the corresponding lugs on the cross-fitting.

CAUTION: DO NOT EXCEED A TORQUE VALUE OF

2,5 daN.m (18.4 lbf.ft).

(h) Secure the lock with 2 split pins (Ref. Fig. 403) (detail B).

(i) Position the spacer and lock it with the appropriate center screw.

(j) Position the cover and secure it with the 2 screws. Torque to 0,6 daN.m (55 lbf.in).

(8) Remove the reheat jet-pipe support frame from the twin secondary nozzle.

(9) Remove the reheat jet-pipe cradle.

(10) Remove first the lower then the upper primary nozzle jacking structures.

(11) Install the "reheat jet-pipe/spherical flange adaptor"
R connecting link. Apply lubricant S to the spherical
R box attachment screws and torque to 1 daN.m
R (90 lbf.in).

(12) Reconnect the primary nozzle jacks air supply pipe. Torque the nut to 5 daN.m (37 lbf.ft) then wire-lock to secure.

(13) Reconnect and wire-lock the cable connector to the primary nozzle area transducer.

(14) Reconnect the reheat jet-pipe fuel drainage tube coming from the rear flange. Torque the nut to 1,9 daN.m (14 lbf.ft) then wire-lock to secure.

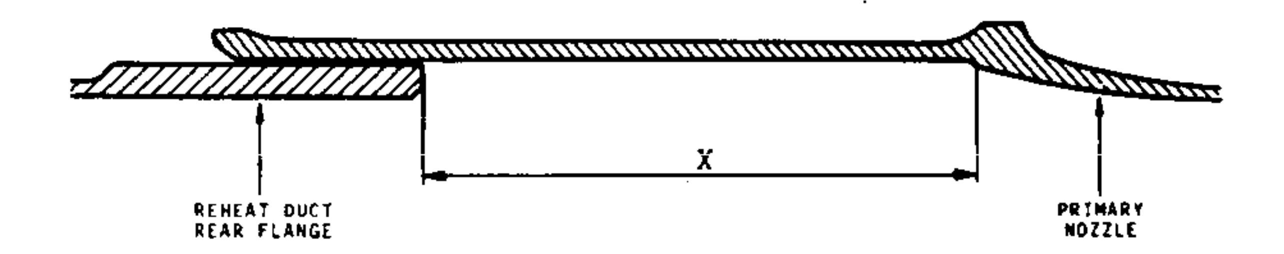
(15) Reconnect the reheat pneumatic detection flexible pipe. Torque the serrated nut to 1,9 daN.m (14 lbf.ft) then wire-lock to secure.

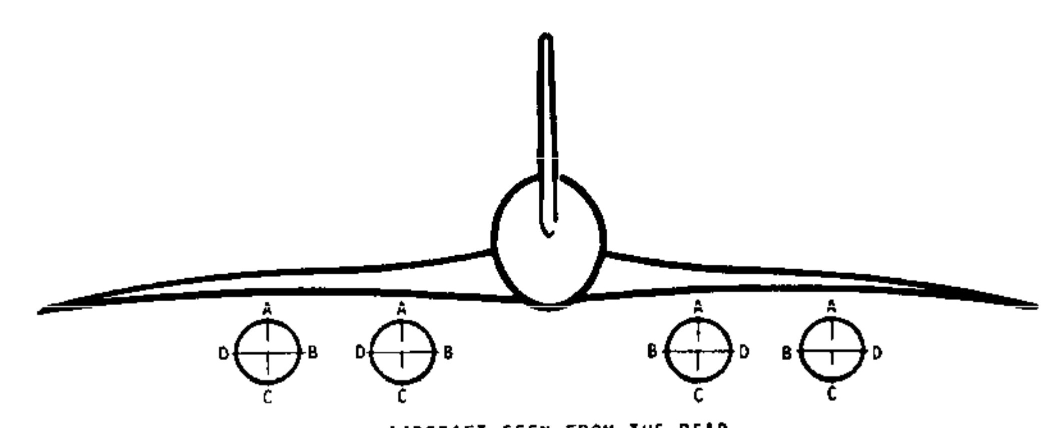
(16) Install the Primary Nozzle Control Assembly Trim Unit (N.C.T.U.) and the Primary Nozzle Control Assembly Pneumatic Valve (P.N.C.) to the nacelle wall (Ref. 76-13-21).

F. Final Inspection.

(1) Check the correct overlap length of the primary nozzle over the reheat duct rear flange by measuring dimension X (Ref. Fig. 405).

<u>WARNING:</u> MAKE SURE THAT NO SOURCE OF COMPRESSED AIR





AIRCRAFT ON LANDING GEAR		ALL BAYS			
		A	B	C	D
DIMENSION X	MINI	46 mm (1.81 in.)	50 mm (1.97 in.)	53 mm (2.09 in.)	49 mm (1.93 in.)
	MAXI	69 mm (2.72 in.)	66 mm (2.60 in.)	61,5 mm (2.42 in.)	64,5 mm (2.54 in.)

CMS 78 11 01 4 EAM0

Measure Dimension X
Figure 405

IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE BEFORE ENTERING THE JET PIPE.

(2) Check for correct position and securing of the spherical joint box.

(3_ Check for correct position and securing of the primary nozzle air supply connection

(4) Check for correct position and securing of the reheat pneumatic detection pipe connection.

(5) Check for correct position and securing of the reheat jet-pipe fuel drainage tube connection.

(6) Check the primary nozzle area indication circuit for continuity.

(a) Reset the nozzle area indication circuit-breaker.

(b) Move manually the primary nozzle petals and check that AJ indicator needle in cockpit centre panel is moving.

<u>WARNING:</u> MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE.

(7) Remove circuit-breaker safety clips and reset all circuit-breakers (Ref. Table 401).

3. <u>Reheat Jet Pipe, Basic Engine Removed</u>

A. Equipment and Materials.

DESCRIPTION	PART NO.
Mini-lift (250kg-5cwt) fitted with 1220 mm (48 in) extension (2 off)	-
Suspension cord	E.93.5014.000
Top sheath unit	E.93.5015.000
Sling	E.93.5013.000
Jet pipe cradle	E.93.5002.000
Jet pipe support beams	
- front beam :	E.93.5003.000
- rear beam :	E.93.5003.001
Support frame	E.93.5004.000
Jet pipe upper jacking structure	E.93.5016.000
Jet pipe lower jacking structure	E.93.5017.000
Jet pipe front support link	E.93.5010.000

Torque wrench (0 to 3 daN.m in range) -
Circuit breaker safety clips -

B. Prepare to Remove Reheat Jet Pipe (Ref. Fig. 406)

NOTE: The removal of the basic engine has led to the installation of a jet pipe cradle and a support frame. However, to facilitate access to the primary assembly (jet pipe and primary nozzle) or closing of the engine bay door, the jet pipe cradle and support frame should be replaced by the reheat jet pipe front support link.

(1) Electrically isolate the engine and exhaust assembly services indicated in Table 402 by tripping the circuit breakers affecting engines in the nacelle upon which work is being carried out. Fit circuit breaker safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENGINE No.1			
MAIN THROT SUP	2-213	1K1	F12
ENG 1 % AREA (AJ) IND	14-215	1E81	C13
ENGINE No.2			
MAIN THROT SUP	2-213	2K1	C12
ENG 2 % AREA (AJ) IND	13-215	2E81	D13
ENGINE No.3			
MAIN THROT SUP	2-213	3K1	C13
ENG 3 % AREA (AJ) IND	13-216	3E81	B 6
ENGINE No.4			
MAIN THROT SUP	2-213	4K1	F13
ENG 4 % AREA (AJ) IND	14-216	4E81	B 6

Circuit Breakers
Table 402

(2) Remove the Primary Nozzle Control Assembly Trim Unit (N.C.T.U.) and the Primary Nozzle Control Assembly

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FRONT SUSPENSION LINK
F
JET PIPE SUPPORT CRADLE
SUPPORT FRAME
F
MINI-LIFT EXTENSION
TOP SHEATH UNIT ON NACELLE WALL
F_1
SLINGS
F_1
SUSPENSION CORD
FRONT HOISTING BAR - BEAM
MINI-LIFT
SUPPORT FRAME
REAR HOISTING BAR - BEAM
CMS 78 11 01 4 CAMO

Reheat Jet Pipe Removal, Basic Engine Removed
Figure 406

Pneumatic Valve (P.N.C) from the nacelle wall (Ref. 76-13-21).

(3) Position the hoist on the top sheath unit fitted on the nacelle wall.

(4) Position the suspension cord on the engine access door and connect it to the hoist extension.

(5) Attach the front and rear hoisting beams on the reheat jet pipe cradle.

(6) Hook the slings to the jet pipe support hoisting beams and to the ends of the hoist cables.

C. Remove the Jet Pipe (Ref. Fig. 406).

(1) Actuate both hoists so as to support the weight of the reheat jet pipe.

(2) Remove jet pipe support frame.

(3) Actuate both hoists simultaneously to lower the reheat jet pipe.

CAUTION: GUIDE THE JET PIPE VERY CAREFULLY AND MAKE SURE THAT IT DOES NOT CONTACT ANY OF THE NACELLE EQUIPMENT DURING THIS OPERATION.

D. Prepare to Install Reheat Jet Pipe (Ref. Fig. 406).

NOTE: It is assumed that the hoists placed for the removal are still in place.

(1) The reheat jet pipe being on its container base, fit it with reheat jet pipe cradle and front and rear hoisting beams.

(2) Bring the reheat jet pipe into it's horizontal position and let it rest on its support.

(3) Connect the slings to the front and rear reheat jet pipe cradle hoisting beams.

E. Install Reheat Jet Pipe (Ref. Fig. 406).

(1) Actuate both hoists simultaneously to raise the reheat chamber.

CAUTION: GUIDE THE JET PIPE VERY CAREFULLY AND MAKE SURE THAT IT DOES NOT CONTACT ANY OF THE

NACELLE EQUIPMENT DURING THIS OPERATION.

(2) Install the jet pipe support frame and fit it on the twin secondary nozzle.

(3) Allow the weight of the reheat chamber to rest on the support frame by slackening the cables of both hoists.

(4) Push the reheat chamber manually to the rear and engage its rear flange in the primary nozzle front flange.

(5) Disconnect the slings from the hoisting beams and remove both hoists.

(6) Install the front suspension link to the upper part of the nacelle and connect it to the reheat jet pipe front suspension fitting.

NOTE: This operation is optional. It is essentially meant to facilitate access to the primary assembly (jet pipe and primary nozzle) and if required the closing of the engine door.

(7) Adjust the reheat jet pipe support ball casters feet so as to bring the link to support the weight of the jet pipe.

(8) Remove the support frame.

(9) Remove the reheat jet pipe support.

NOTE: Operations (7 to 9) are only carried out if the front suspension link has been installed previously.

(10) Install the Primary Nozzle Control Assembly Trim Unit (N.C.T.U.) and the Primary Nozzle Control Assembly Pneumatic Valve (P.N.C.) to the nacelle wall (Ref. 76-13-21).

F. Final Inspection

(1) Check for correct position and securing of the primary nozzle air supply connection.

(2) Remove circuit-breaker safety clips and reset all circuit-breakers (Ref. Table 402).

REHEAT JET PIPE - INSPECTION/CHECK

1. General

This chapter defines the inspection to be carried out and the acceptance criteria related to damage affecting the reheat jet
R pipe.

2. Prepare Reheat Jet Pipe for Examination

A. Electrically isolate the engine and exhaust assembly services indicated in Table 601 by tripping the circuit breakers affecting engines in the nacelle upon which work is being carried out. Fit circuit breakers safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINE No. 1			
REHEAT CONT.	15-216	1 K 1542	E 9
REHEAT AMP SUP.	14-215	1 K 1541	C 12
REHEAT IGNITION SUP PH A.	14-215	1 K 1543	B 13
REHEAT IGNITION SUP PH C.	14-215	1 K 1544	F 12
ENGINE No.2			
REHEAT CONT.	15-215	2 K 1542	D 15
REHEAT AMP SUP.	13-215	2 K 1541	B 14
REHEAT IGNITION SUP PH A.	13-215	2 K 1543	A 14
REHEAT IGNITION SUP PH C.	13-215	2 K 1544	E 14
ENGINE No.3			
REHEAT CONT.	15-215	3 K 1542	D 16
REHEAT AMP SUP.	13-216	3 K 1541	B 7
REHEAT IGNITION SUP PH A.	13-216	3 K 1543	A 5
REHEAT IGNITION SUP PH C.	13-216	3 K 1544	F 6
ENGINE No.4			
REHEAT CONT.	15-216	4 K 1542	E 10
REHEAT AMP SUP.	14-216	4 K 1541	D 7
REHEAT IGNITION SUP PH A.	14-216	4 K 1543	A 6
REHEAT IGNITION SUP PH C.	14-216	4 K 1544	E 7

Circuit Breakers
Table 601

WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE.

B. Carry out the safety precautions and work sequences required for access to the jet pipe as detailed in 71-00-00, Servicing.

WARNING: HIGH ENERGY IGNITION EQUIPMENT CAN BE LETHAL. COMPLY WITH THE SAFETY PRECAUTIONS DETAILED IN CHAPTER 12.

C. Display a suitable placard on the engine starting panel indicating that personnel are working on the engines and in the twin secondary nozzle area.

D. Gain access to the ventilation shroud by opening the relevant access door.

3. Examine the Reheat Jet Pipe.

A. Visual Inspection

(1) Get into the reheat jet pipe and inspect the reheat duct for damage. Impact marks are acceptable if devoid of cracks, nicks/or missing material. No crack is acceptable anywhere on the duct.

(2) Inspect the anti-screech liner for damage. Detached material and more than one missing bolt unacceptable. Cracks are acceptable provided that they do not exceed the acceptance criteria specified values.

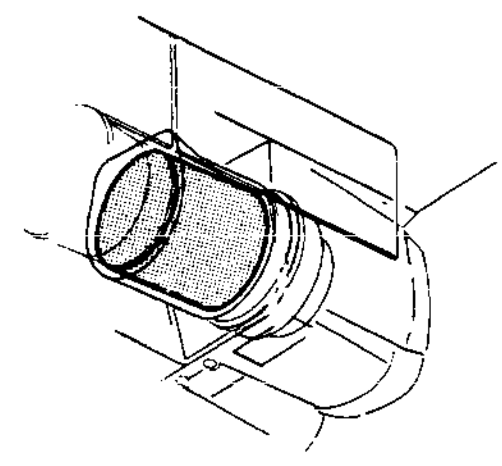
(3) Inspect the ventilation shroud for damage.

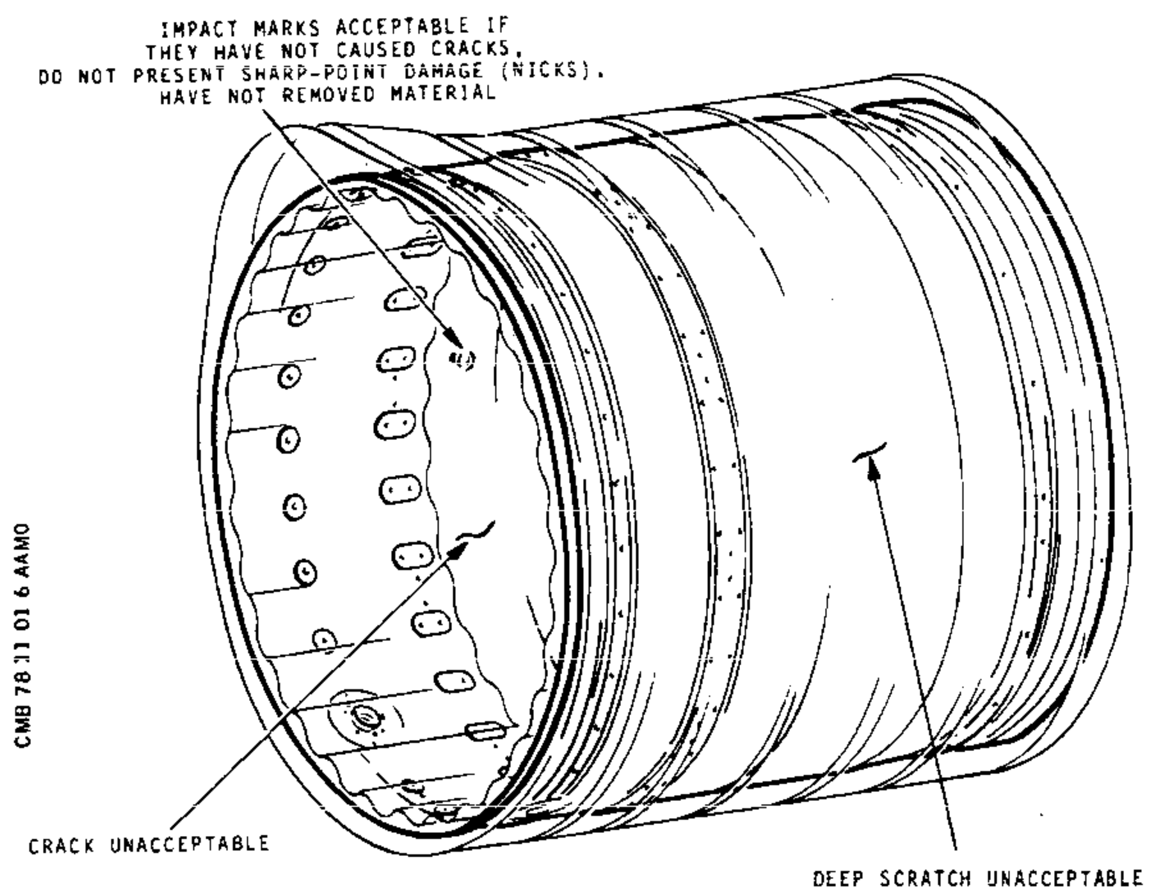
NOTE: Only partial inspection of the ventilation shroud will be carried out as the upper part is not visible when reheat jet pipe is installed on the aircraft.

4. Acceptance Criteria (Ref. Fig. 601, 602 and 603) (Ref. Fig. 604, 605 and 606)

A. Compare reheat jet pipe damage with the criteria specified on the appropriate series of illustration sheets.

B. If damage exceeds the specified dimensions, reject the component for rectification.





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Inspection of Reheat Jet Pipe Reheat Duct
Acceptance Criteria
Figure 601

1 MISSING SPACER
UNACCEPTABLE

DISTORTION DUE TO
IMPACTS ACCEPTABLE

CMB 78 11 01 6 BAMO

Inspection of Reheat Jet Pipe Ventilation
Shroud Acceptance Criteria
Figure 602

CRACK ACCEPTABLE IF LENGTH DOES NOT EXCEED 10 MM (0.39 IN.)

PART RETURNED UNACCEPTABLE RETURN TO MAIN BASE AUTHORIZED AFTER CUTTING OFF AND GRINDING THE REWORKED SECTION

IMPACTS ASSOCIATED WITH CRACKS ACCEPTABLE IF LENGTH DOES NOT EXCEED 10 MM (0.39 IN.)

DETACHED PART JEOPARDIZING THE EFFICIENCY OF THE ATTACHMENT POINT UNACCEPTABLE. RETURN TO MAIN BASE AUTHORIZED

CRACKS ACCEPTABLE IF WITHIN A RADIUS LESS THAN 40 MM (1.57 IN) STARTING FROM CENTRE OF ATTACHMENT POINT
1 MISSING BOLT ACCEPTABLE
2 MISSING BOLTS, ADJACENT OR NOT UNACCEPTABLE, RETURN TO MAIN BASE AUTHORIZED.

CRACK ON FRONT EDGE ACCEPTABLE IF NOT EXCEEDING 15MM (0.59 IN.)

CMS 78 11 01 6 CAMO

Inspection of Reheat Jet Pipe Anti-screech
Liner Acceptance Criteria
Figure 603

DETACHED MATERIAL ACCEPTABLE IF IT DOES NOT EXCEED 50% OF DEFLECTOR WIDTH AND IF INCLUDED IN A 30 DEGREES AREA

HALF-DEFLECTORS DISENGAGED DUE TO DISTORTION ACCEPTABLE. DEFECT TO BE ELIMINATED AT NEXT INTERVENTION

DETACHED MATERIAL IN FUEL DRAINAGE AREA UNACCEPTABLE

CMS 78 11 01 6 DAMO

Inspection of Reheat Jet Pipe Half-deflectors
Acceptance Criteria
Figure 604

A

A

B

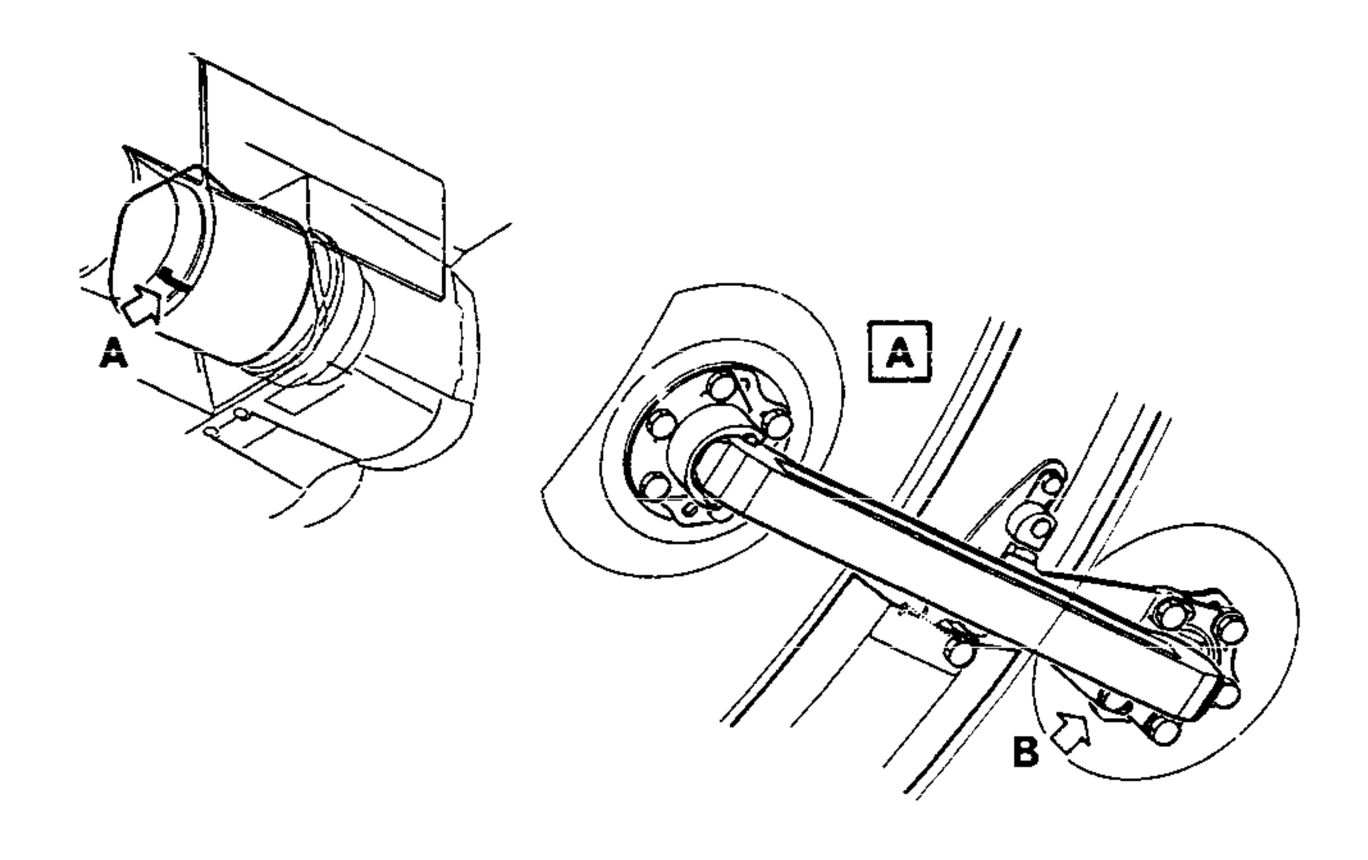
B

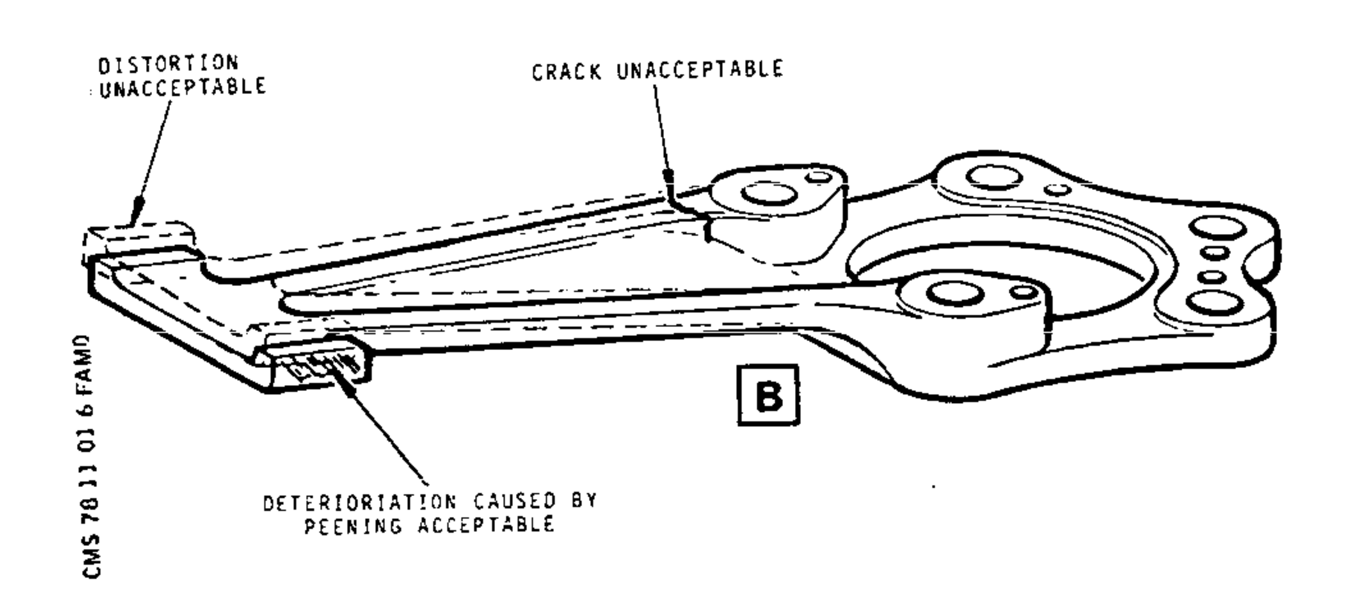
CRACKS UNACCEPTABLE

DISTORTION ACCEPTABLE IF THE DEFLECTION DOES NOT EXCEED OR IS EQUAL TO 1 mm (0.039 in)

CMS 78 11 01 6 EAM0

Inspection of Reheat Jet Pipe Connecting Link
Acceptance Criteria
Figure 605





Inspection of Reheat Jet Pipe Angular
Positioning Stop Acceptance Criteria
Figure 606

PRIMARY NOZZLE - REMOVAL/INSTALLATION

1. General

This topic details the removal/installation of the primary nozzle. This operation requires the preliminary removal of the reheat jet pipe (Ref. 78-11-01, Removal/Installation).

2. Removal/Installation of the Primary Nozzle

A. Equipment and Materials.

	DESCRIPTION	PART NO.
R	Mini-lift (250kg - 5cwt) fitted with 1.220 mm (48 in) Extension (2 off)	-
	Primary nozzle upper jacking structure	E.93.5016.000
	Primary nozzle lower jacking structure	E.93.5017.000
R	Primary nozzle slide rail	E.93.5027.031
	Suspension cord	E.93.5014.000
	Top sheath unit on nacelle wall	E.93.5015.000
R	Sling (2 off)	E.93.5013.000
	Primary nozzle cradle	E.93.5031.030
R	Extractor/Inserter, short nozzle mounting pin	E.92.5003.001
R	Extractor/Inserter, long nozzle mounting pin	E.92.5003.000
R	Locating tool, short, nozzle support attachment	E.92.5004.001
R	Locating tool, long, nozzle support attachment (2 off)	E.92.5004.002
	37 tooth wrench	9970.515.062
	7/16 in hexagon headed wrench	-
	5 in extension	-
	Torque wrench (0 to 3 daN.m in range)	-
	Circuit breaker safety clips	-

B. Prepare to Remove Primary Nozzle (Ref. Fig.401 and 402).

NOTE: If the engine is installed, it is necessary to push back the primary nozzle to remove the reheat jet pipe. In the following operations, we will assume that the basic engine has been removed, which leads to most complete procedure at the primary nozzle level.

(1) Electrically isolate the engine and exhaust assembly services indicated in Table 401 by tripping the cir-

cuit breakers affecting engines in the nacelle upon which work is being carried out. Fit circuit breaker safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINE NO. 1			
MAIN THROT SUP	2-213	1K1	F12
ENG 1% AREA (AJ) IND	14-215	1E81	C13
ENG VIBRATION IND SUP 1	4-213	E512	C18
ENG VIBRATION IND SUP 2	4-213	E513	D18
ENGINE NO. 2			
MAIN THROT SUP	2-213	2K1	C12
ENG 2% AREA (AJ) IND	13-215	2E81	D13
ENG VIBRATION IND SUP 1	4-213	E512	C18
ENG VIBRATION IND SUP 2	4-213	E513	D18
ENGINE NO. 3			
MAIN THROT SUP	2-213	3K1	C13
ENG 3% AREA (AJ) IND	13-216	3E81	B 6
ENG VIBRATION IND SUP 1	4-213	E512	C18
ENG VIBRATION IND SUP 2	4-213	E513	D18
ENGINE NO. 4			
MAIN THROT SUP	2-213	4K1	F13
ENG 4% AREA (AJ) IND	14-216	4E81	B 6
ENG VIBRATION IND SUP 1	4-213	E512	C18
ENG VIBRATION IND SUP 2	4-213	E513	D18

Circuit Breakers
Table 401

(2) Disconnect the primary nozzle jacks air supply pipe. (Ref. Fig. 401)(Detail A).

(3) Disconnect the electrical plug from the primary nozzle area transducer (Ref. Fig. 401)(Detail C).

(4) Release the primary nozzle area transducer electrical cable from the secondary nozzle attachment point (Ref. Fig. 402).

(a) Remove the two nuts and the two hexagonal head bolts (1).

(b) Remove the four hexagonal head bolts (2)

B

A

C

SUPPLY PRESSURE
APPLIED TO REHEAT
DETECTION PRESSURE
SWITCH

B

REHEAT PNEUMATIC
DETECTION PIPE

A

P3 AIR
FROM PNC

PRIMARY NOZZLE JACK
AIR SUPPLY PIPE

C

PRIMARY NOZZLE AREA
TRANSDUCER CONNECTOR

CMS 78 12 01 4 AAM0

Prepare to Remove Primary Nozzle
Figure 401

A

F

HEXAGONAL HEAD BOLT (2) AND WASHER

NUT

HEXAGONAL HEAD BOLT (1)

HALF-CLAMPS SECURING THE CABLE TO THE SECONDARY NOZZLE

F

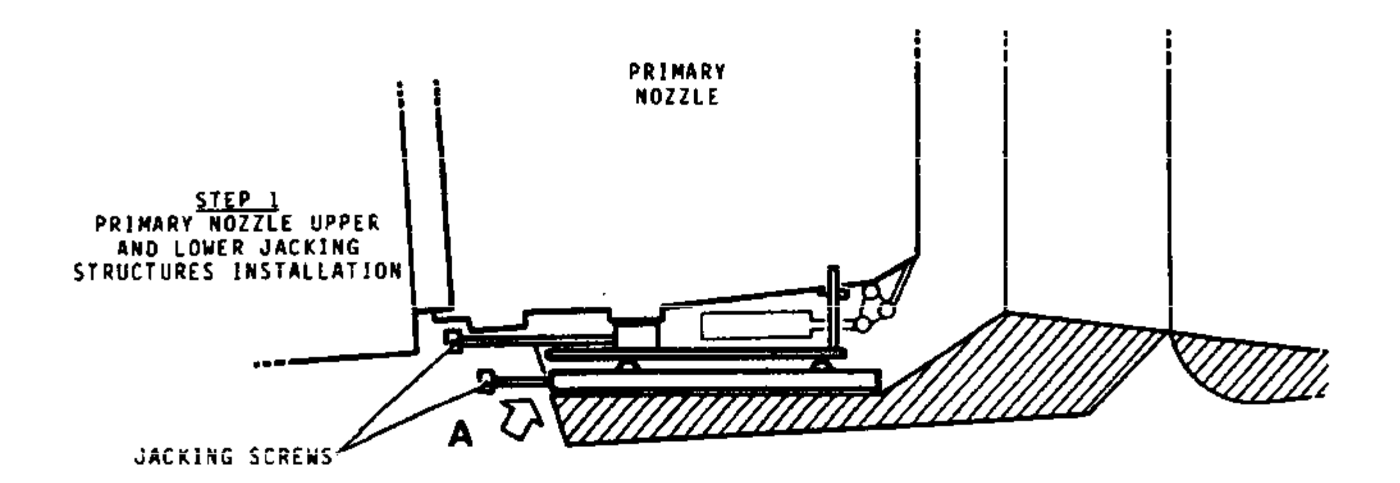
A

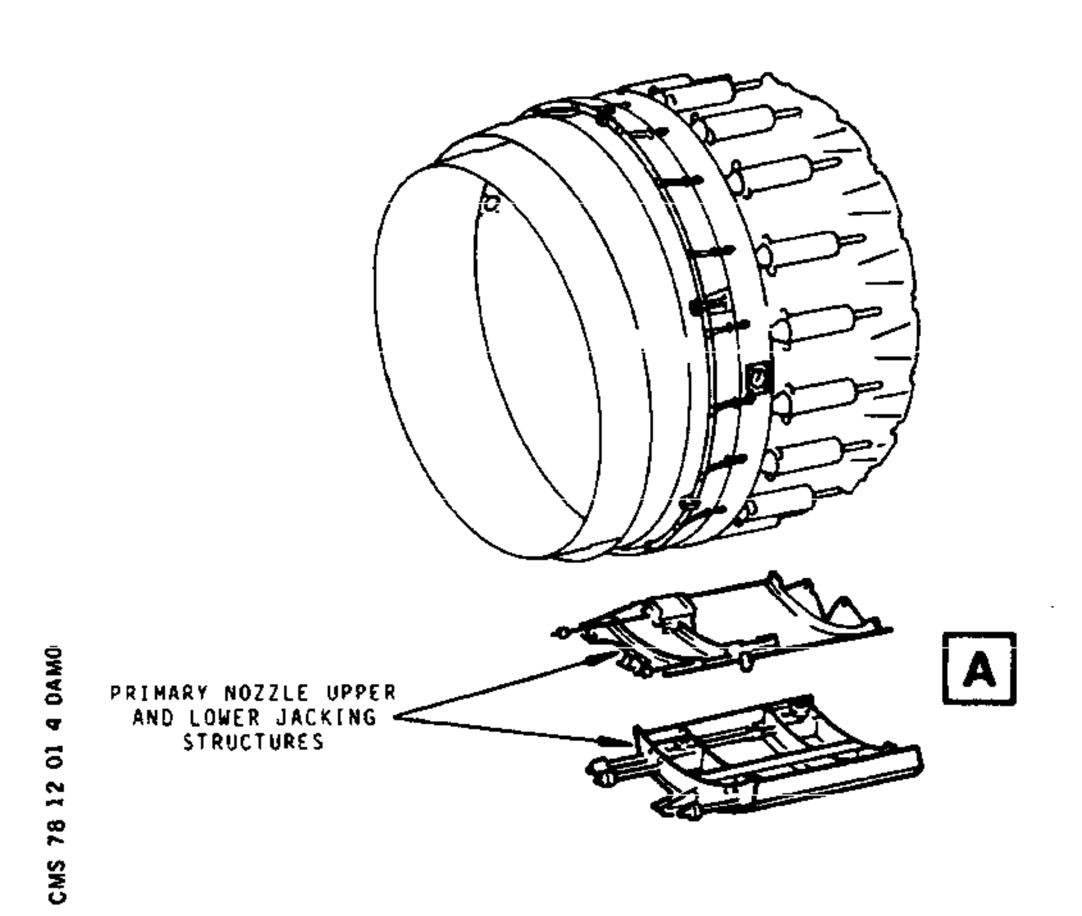
CMS 78 12 01 4 BAMO

Primary Nozzle Area Transducer Electrical Cable
Attachment to Secondary Nozzle
Figure 402

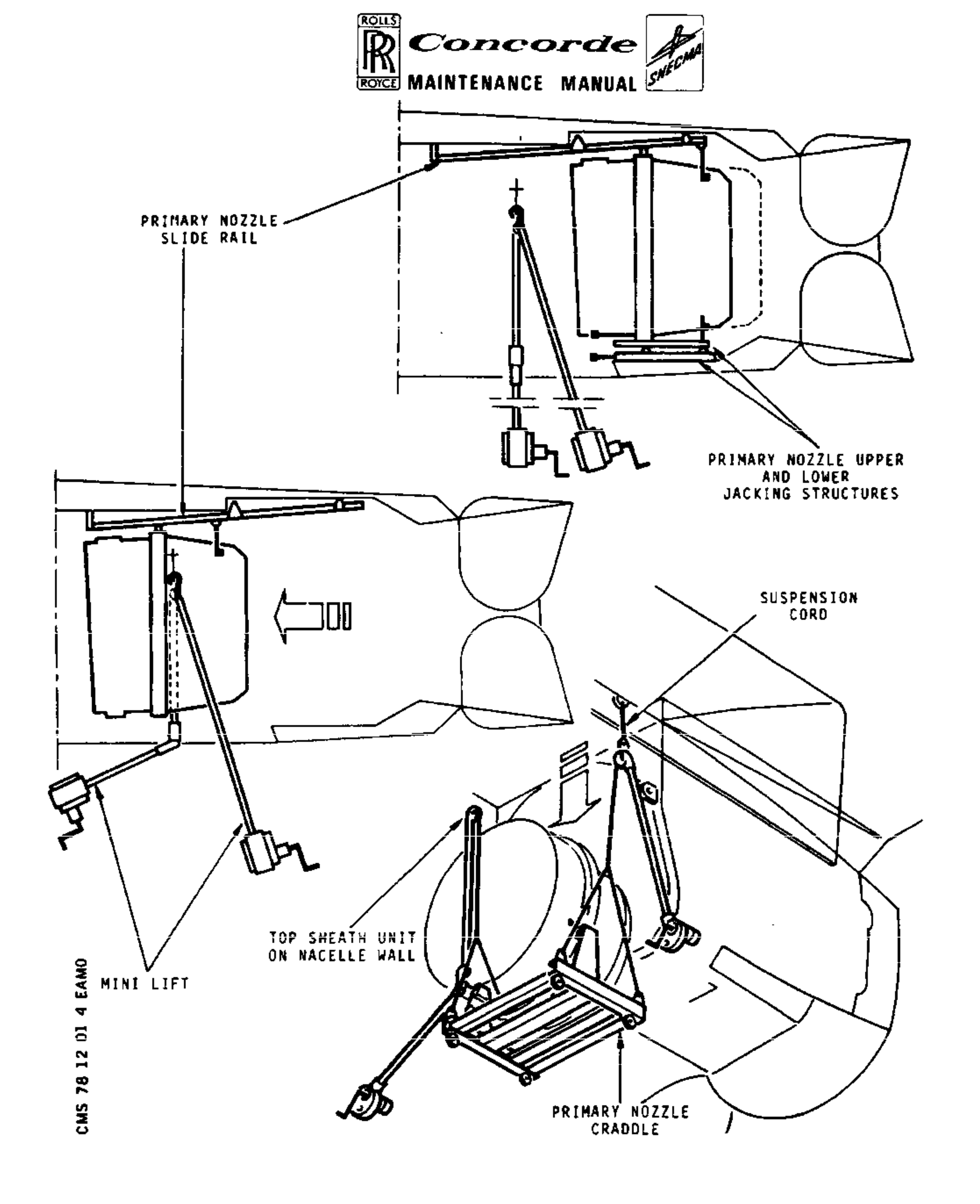
A
A
TWIN SECONDARY NOZZLE
MOUNTING PIN
B
PLATE
SPHERICAL STOP
SPLIT PIN
CROSS-FITTING
LOCK
SPACER
SCREW
B
COVER
COVER RETAINING SCREW
CMS 78 12 01 4 CAMO

Primary Nozzle Mounting Pin Assembly
Upper or Lower Pin
Figure 403

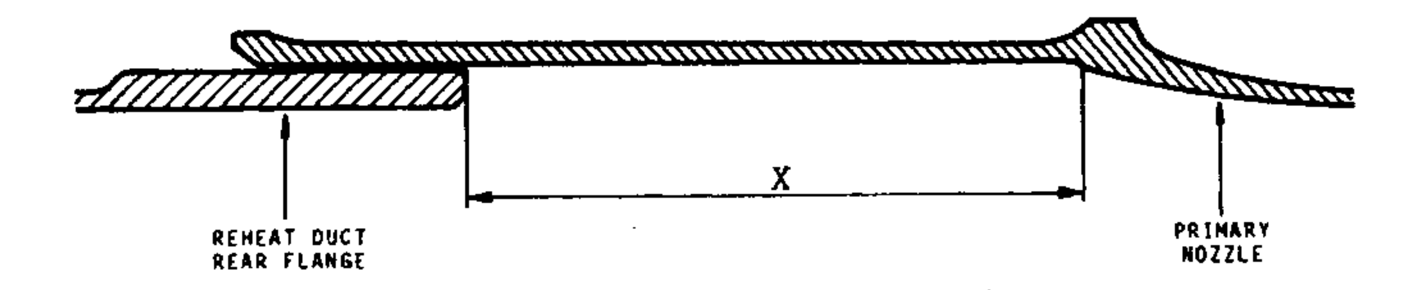


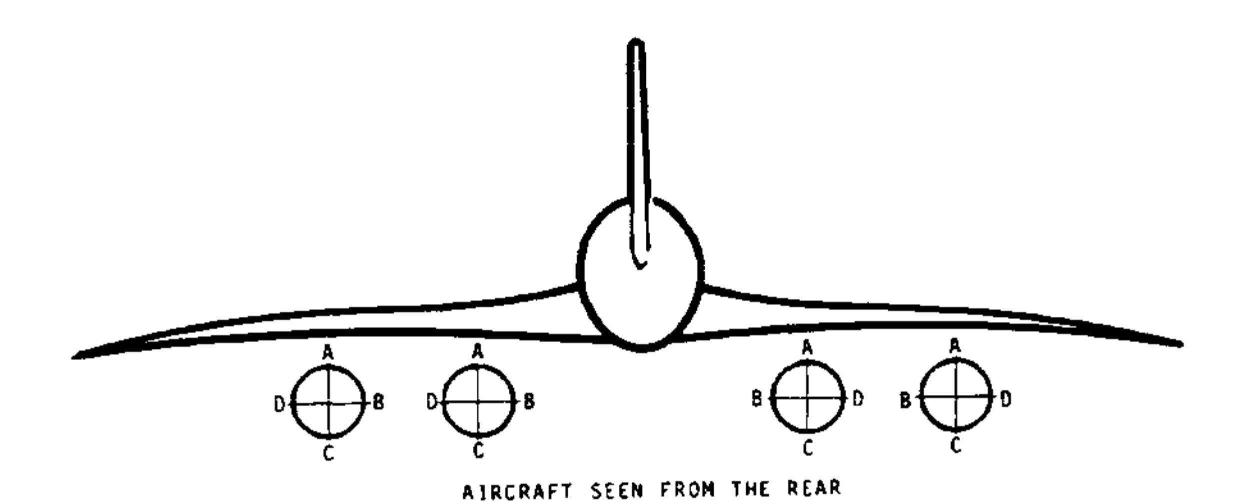


Installation of Primary Nozzle Upper and Lower
Jacking Structures
Figure 404



Removal and Installation of the Primary Nozzle
Figure 405





AIRCRAFT ON LANDING GEAR		ALL BAYS			
		A	B	C	D
DIMENSION X	MINI	46 mm (1.81 in.)	50 mm (1.97 in.)	53 mm (2.09 in.)	49 mm (1.93 in.)
	MAXI	69 mm (2.72 in.)	66 mm (2.60 in.)	61,5 mm (2.42 in.)	64,5 mm (2.54 in.)

CMS 78 12 01 4 FAMO

Measure Dimension X
Figure 406

the two half-clamps to the secondary nozzle and retain the washers.

(c) Remove the two half-clamps securing the cable to the secondary nozzle.

(d) Bend down the primary nozzle area transducer cable towards the front of the secondary nozzle and secure it to the latter using brass wire.

(5) Disconnect the reheat pneumatic detection flexible pipe (Ref. Fig. 401)(Detail B).

(6) Remove the primary nozzle attachment pins access covers (Ref. Fig. 403).

R CAUTION: BEFORE CARRYING OUT ANY WORK, THE SECONDARY
R NOZZLE MUST BE LINED WITH RUBBER CARPETS TO
R AVOID DAMAGE RESULTING FROM ACCIDENTAL
R BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES
R MUST BE WORN WHEN STEPPING ON THE NOZZLE.

C. Remove Primary Nozzle (Ref. Fig. 403, 404 and 405).

(1) Attach the upper jacking structure to the primary nozzle (Ref. Fig. 404).

(2) Position the lower jacking structure then, adjust the jacks so as to support the weight of the primary nozzle (Ref. Fig. 404).

(3) Remove each of the nozzle mounting pins (Ref. Fig. 403).

(a) Remove the spacers.

NOTE: The side mounting pins are not fitted with spacers.

(b) Remove the split pins securing the locks.

(c) Remove the locks.

(d) Using the hexagon wrench and extension unscrew the spherical stops and remove the cross-fittings.

(e) Remove the plates.

(f) Using the appropriate extractor/inserter tool, remove each mounting pin in turn.

NOTE: For the upper and lower pins, use the long extractor. For the pin accessible via the side-wall, use the short extractor.

(4) Fit the slide rail on the twin secondary nozzle and nacelle.

(5) Attach the primary nozzle on the rail.

NOTE: Adjust the jacking structure if required to facilitate the rail/nozzle liaison

(6) Lower the jacking structure jacks and remove the jacking structure after having retracted the stop.

(7) Remove the upper jacking structure from the nozzle.

(8) Move the primary nozzle forward.

CAUTION: GUIDE THE PRIMARY NOZZLE VERY CAREFULLY AND MAKE SURE THAT IT DOES NOT CONTACT ANY OF THE NACELLE EQUIPMENT DURING THIS OPERATION.

(9) Install the cradle on the primary nozzle.

(10) Connect the slings to the primary nozzle cradle and to the hoists cable ends.

(11) Actuate the two hoists so as to take the weight of the primary nozzle.

(12) Unhook the primary nozzle from the rail.

(13) Actuate both hoists simultaneously to lower the primary nozzle.

D. Prepare to Install Primary Nozzle

NOTE: It is assumed that the hoists and the rail used for the removal are still in position in the nacelle.

(1) Smear all liaison parts of the primary nozzle mounting pins with lubricant S (Ref. 70-00-01).

(2) Smear plate (6), spherical stop and cross-fitting with lubricant J (Ref. 70-00-01).

(3) Position the primary nozzle on its cradle.

(4) Connect the slings to the cradle.

E. Install Primary Nozzle (Ref. Fig. 403, 404 and 405).

(1) Actuate both hoists simultaneously to raise the primary nozzle.

<u>CAUTION</u>: GUIDE THE PRIMARY NOZZLE VERY CAREFULLY AND MAKE SURE THAT IT DOES NOT CONTACT ANY OF NACELLE EQUIPMENT DURING THIS OPERATION.

(2) Hook the primary nozzle on the rail.

(3) Slacken both hoist cables and unhook the slings from the cradle.

(4) Remove both hoists and extension tubes from the nacelle.

(5) Remove the test stand from the primary nozzle.

(6) Attach the upper jacking structure on the primary nozzle (Ref. Fig. 404).

(7) Push the primary nozzle on its rail until it reaches the rear stop.

(8) Position the lower jacking structure between the upper structure and the twin secondary nozzle. (Ref. Fig. 404).

(9) Actuate the lower jacking structure jacks to take-up the weight of the primary nozzle.

(10) Unhook the primary nozzle from the rail and remove the rail.

<u>NOTE</u>: Should the reheat jet pipe have been removed and the basic engine still be installed it is advisable to install the jet pipe (78-11-00, 2D and E) before proceeding with (11). This will avoid the subsequent need to re-disturb the primary nozzle.

(11) Move the primary nozzle so as to bring in coincidence the primary nozzle attachment points and the pin housings axes in the twin secondary nozzle.

(12) Retain the primary nozzle in this position by inserting the locating tools, one at a time in the order lower-upper-side. Each tool must be fully

engaged with the locking pins in and the probe free to rotate.

R CAUTION: BEFORE CARRYING OUT ANY WORK, THE SECONDARY
R NOZZLE MUST BE LINED WITH RUBBER CARPETS TO
R AVOID DAMAGE RESULTING FROM ACCIDENTAL
R BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES
R MUST BE WORN WHEN STEPPING ON THE NOZZLE.

NOTE: At the lower and upper attachments use the long locating tools. At the attachment accessible via the sidewall insert the short locating tool (Ref. Fig. 403).

(13) Remove each locating tool in turn (in the same order as above) and replace it with a nozzle mounting pin, using the appropriate long or short extractor/inserter tool.

(a) Using the hexagon wrench and extension screw the spherical stop fully into the cross-fitting.

(b) Position the plate in the pin.

(c) Position the cross-fitting and lock it in position.

(d) Screw the spherical stop so as to cancel plays.

(e) Make sure that all parts are correctly positioned.

(f) Torque the spherical stop to 2,5 daN.m (222 lbf.in). then slacken.

(g) Torque the spherical stop to final value:

(i) First to 1,30 daN.m (115 lbf.in).

(ii) Try to position the lock on the cross-fitting.

(iii) If assembly is not possible, tighten the spherical stop further until the lock apertures line-up with the corresponding lugs on the cross-fitting.

CAUTION: DO NOT EXCEED A TORQUE VALUE OF 2,5 daN.m (222 lbf in).

(h) Secure the lock with two split pins

(Ref. Fig. 403)(Detail B).

(i) Position the spacer and lock it with the appropriate center screw.

(j) Position the cover and secure it with the two screws. Torque to 0,6 daN.m (53 lbf.in).

(14) Remove first the lower then the upper primary nozzle jacking structures (Ref. Fig. 404).

F. Final Fitting-out of the Primary Nozzle.
(Ref. Fig.401 and 402).

(1) Reconnect the reheat pneumatic detection flexible pipe, (Ref. Fig. 401)(Detail B). Torque the serrated nut to 1,9 daN.m (168 lbf.in).

(2) Reposition the primary nozzle area transducer electrical cable (Ref. Fig. 402).

(a) After cutting off the brass wire and straightening up the AJ cable, position the two half-clamps securing the cable to the secondary nozzle.

CAUTION: THE PARTING LINE OF THE TWO HALF-CLAMPS MUST BE IN THE SAME DIRECTION AS JET STREAM AXIS. THE CONNECTOR LOCATING PEG MUST BE DIRECTED TOWARDS R.H. SIDE, NOZZLE SEEN FROM REAR.

(b) Position the two hexagonal head bolts (1)
R and hand-tighten the nuts.
NOTE: The nuts must be facing the secondary nozzle side wall.

(c) Fit the four hexagonal head bolts (2) with their washer. Do not tighten.

(d) Torque tighten the two hexagonal head bolts (1) from 0,3 to 0,4 daN.m (26.6 to 35.4 lbf.in).

(e) Torque tighten the four hexagonal head bolts bolts (2) to 0,3 to 0,4 daN.m (26.6 to 35.4 lbf.in).

(3) Reconnect and wire-lock the cable connector to the primary nozzle area transducer. (Ref. Fig. 401),

(Detail C).

(3) Reconnect the primary nozzle jacks air supply pipe. (Ref. Fig. 401),(Detail A). Torque the nut to 5 daN.m (37 lbf.ft).

(5) Re-install the reheat jet-pipe (Ref. 78-11-01, Removal/Installation).

G. Final Inspection

(1) Check the correct overlap length of the primary nozzle over the reheat duct rear flange by measuring dimension X (Ref. Fig. 406).

WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE BEFORE ENTERING THE JET-PIPE.

(2) Check for correct position and securing of the primary nozzle air supply connection.

(3) Check for correct position and securing of the reheat pneumatic detection pipe connection.

(4) Carry out an operational test of the primary nozzle area indication system.

(a) Reset the primary nozzle area indication circuit-breaker.

(b) Fully close then open manually the primary nozzle petals and read the corresponding nozzle area values in the cockpit. These values must be respectively 8 and 91 per cent plus or minus 4 per cent. Adjust if required the lenght of the area detection connecting rod through rotation of the rod end-piece.

(5) Remove circuit-breaker safety clips and reset all circuit-breakers (Ref. Table 401).

PRIMARY NOZZLE - INSPECTION/CHECK

1. General

This chapter defines the inspection to be carried out and the acceptance criteria related to damage affecting the primary nozzle. It also specifies defects which cannot be found during ordinary visual inspection, but that could become visible on removal of a sub-assembly.

2. Prepare Primary Nozzle for Examination

A. Electrically isolate the engine and exhaust assembly services indicated in Table 601 by tripping the circuit breakers affecting engines in the nacelle upon which work is being carried out. Fit circuit breaker safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINE No.1			
MAIN THROT SUP.	2-213	1K1	F12
R % AREA (AJ) IND.	14-215	1E81	C13
ENG VIBRATION IND SUP. 1	4-213	E512	C18
ENG VIBRATION IND SUP. 2	4-213	E513	D18
ENGINE No.2			
MAIN THROT SUP.	2-213	2K1	C12
R % AREA (AJ) IND.	13-215	2E81	D13
ENG VIBRATION IND SUP.1	4-213	E512	C18
ENG VIBRATION IND SUP.2	4-213	E513	D18
ENGINE No.3			
MAIN THROT SUP.	2-213	3K1	C13
% AREA (AJ) IND.	13-216	3E81	B 6
ENG VIBRATION IND SUP.1	4-213	E512	C18
ENG VIBRATION IND SUP.2	4-213	E513	D18
ENGINE No.4			
MAIN THROT SUP.	2-213	4K1	F13
% AREA (AJ) IND.	14-216	4E81	B 6

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENG VIBRATION IND SUP.1	4-213	E512	C18
ENG VIBRATION IND SUP.2	4-213	E513	D18

Circuit Breakers
Table 601

WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE.

B. Carry out the safety precautions and work sequences required for access to the jet pipe as detailed in 71-00-00, Servicing.

C. Display a suitable placard on the engine starting panel indicating that personnel are working on the engines and in the twin secondary nozzle.

R D. Gain access to the nozzle front fairing by opening the
R relevant engine access door.

3. Examine the Primary Nozzle

A. Visual Inspection

(1) Inspect the nozzle front fairing for damage. Cracks and distortion are acceptable. Detached material is acceptable provided that the deteriorated area does not exceed 25 sq. cm (3.88 sq.in). The return to main base is authorized for a deterioration of 50 sq. cm (7.75 sq.in).

NOTE: Only partial inspection of the nozzle front fairing will be carried out as the upper part is not visible when primary nozzle is installed on the aircraft.

(2) Inspect the nozzle closing manifold for damage. Check that there is no crack on the elbow supply pipe welded to the manifold. Failure of elbow is unacceptable. Failure of jack air supply tubes is acceptable on three non adjacent jacks.

(3) Get into the secondary nozzle and inspect the convergent section for damage. Impact marks are acceptable if they are not accompanied by cracks, do not comprise sharp point damage (nicks), and no material has been removed. No crack anywhere in the convergent section is acceptable.

(4) Inspect the jointing segment located between the convergent section and the petals. Check that there is no detached material.

(5) Inspect the nozzle petal control linkage. Check the follower petals for position and ensure that there is no broken attachment lug.

R (6) Refer to Fig. 607

R Inspect convergent section of nozzle, in particular
R the flap twin yoke fixing bolts.

R 90 off nuts should be visible when viewed from rear.

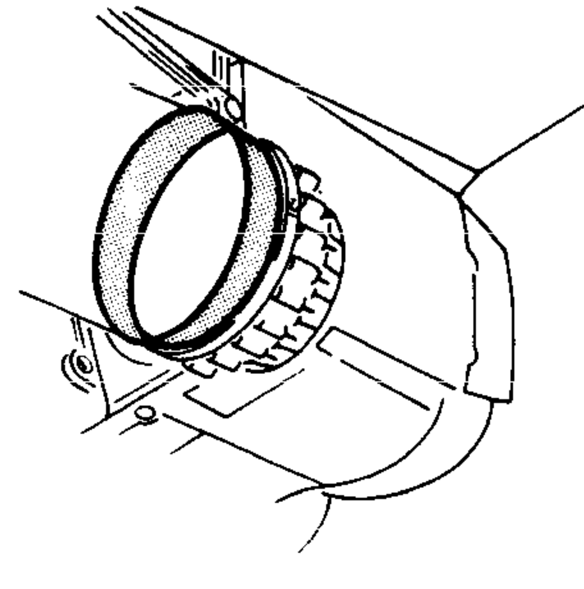
R Reject any Primary Nozzle that has a bolt/nut missing.

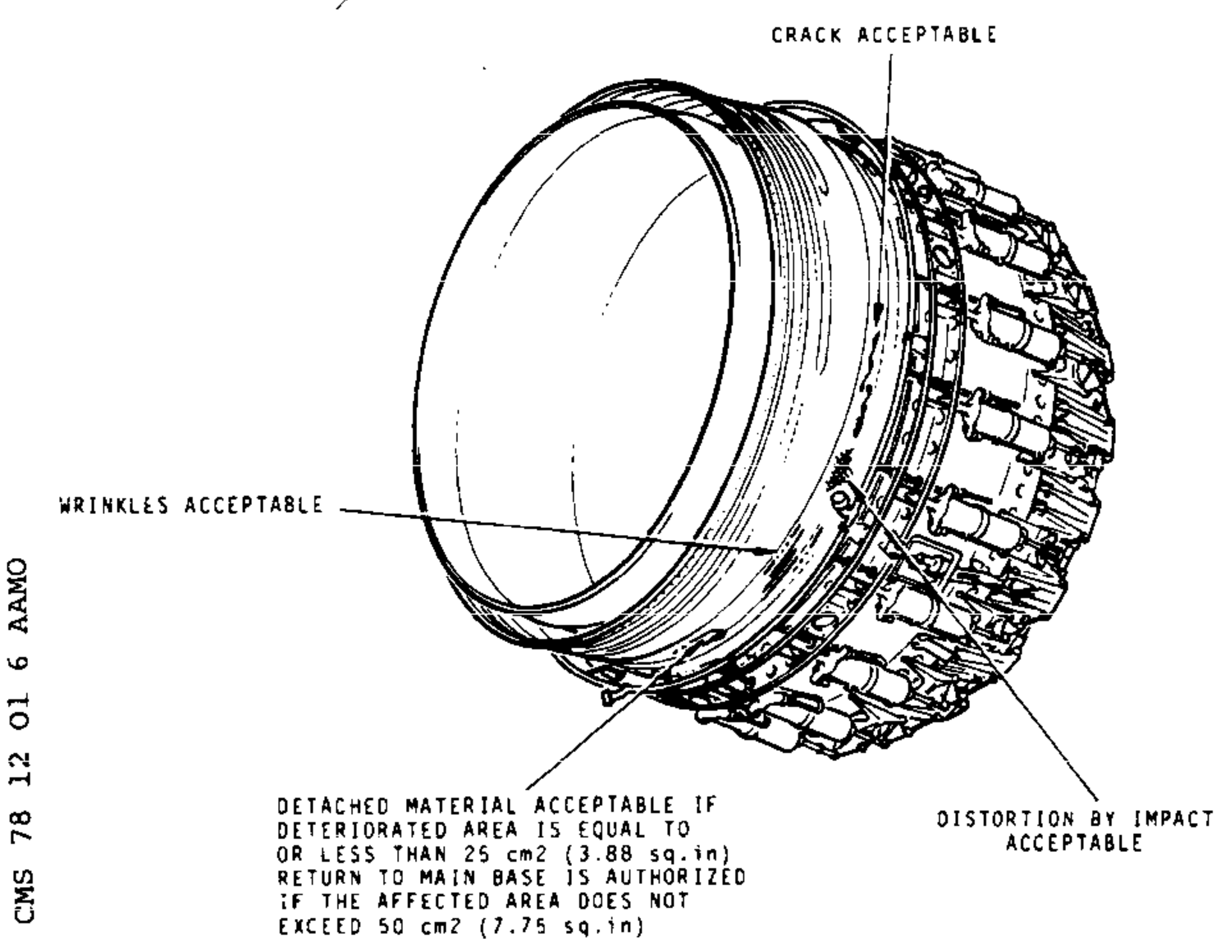
R <u>NOTE:</u> If one bolt/nut is found missing, nozzle must
R be rejected from aircraft.
R One sector, to return to base, is permitted
R with this defect.

4. <u>Acceptance Criteria</u> (Ref. Fig. 601, 602 and 603) (Ref. Fig. 604, 605 and 606)

A. Compare primary nozzle damage with the criteria specified on the appropriate series of illustration sheets.

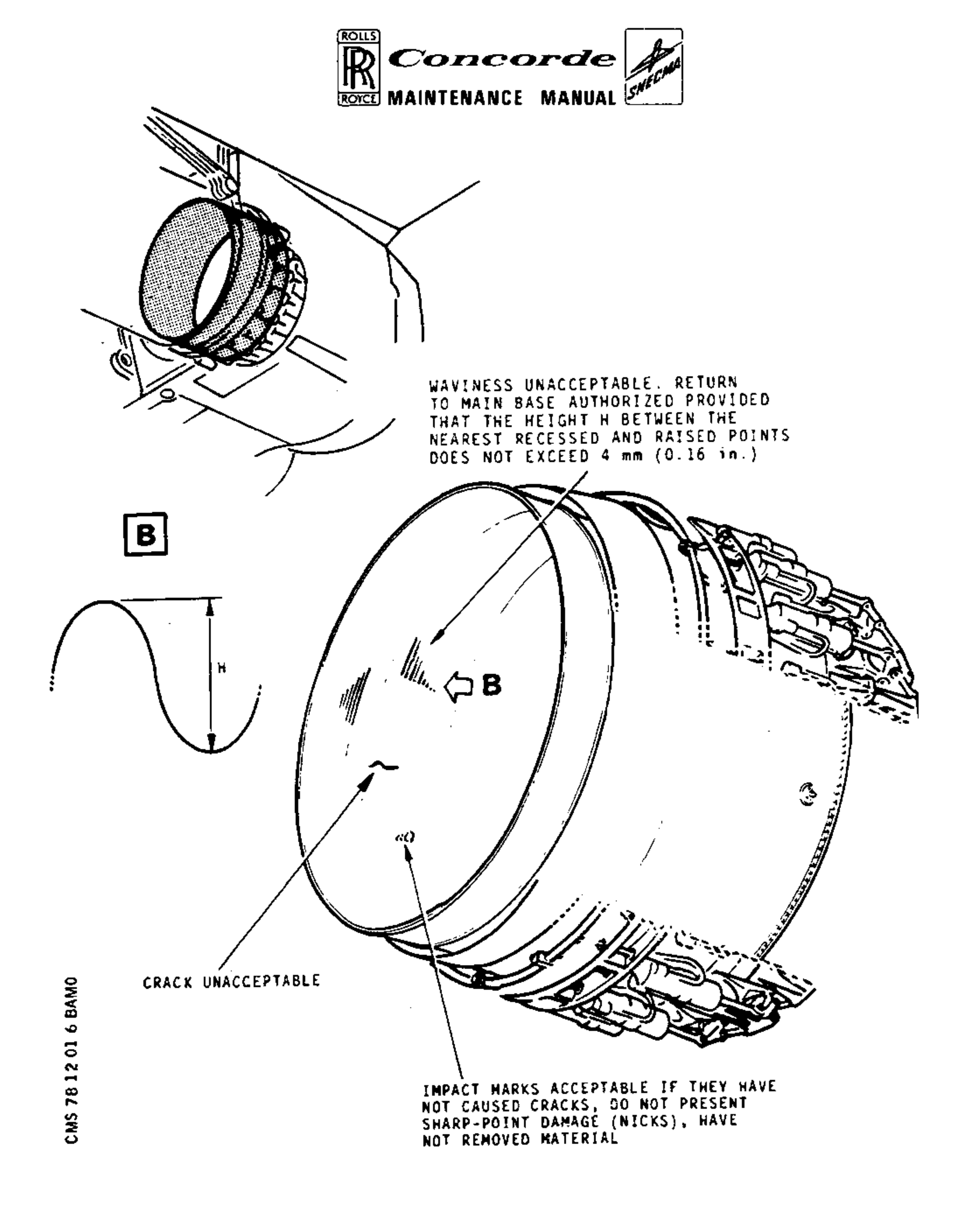
B. If damage exceeds the specified dimensions, reject the component for rectification.





CMS 78 12 01 6 AAMO

Inspection of Primary Nozzle
Nozzle Front Fairing Acceptance Criteria
Figure 601



Inspection of Primary Nozzle
Convergent Section Acceptance Criteria
Figure 602

R

A

A

CMS 78 12 01 6 CAMO

DISTORTION AT PETAL END LEVEL ACCEPTABLE

DETACHED MATERIAL UNACCEPTABLE. RETURN TO MAIN BASE AUTHORIZED

CRACK ACCEPTABLE IF LENGTH DOES NOT EXCEED 5 mm (0.197 in)

Inspection of Primary Nozzle
Jointing Segment Acceptance Criteria
Figure 603

B

FAILURE OF ONE ATTACHMENT LUG UNACCEPTABLE. RETURN TO MAIN BASE AUTHORIZED

A

MISSING OR DETACHED ACTUATED OR FOLLOWER PETAL UNACCEPTABLE

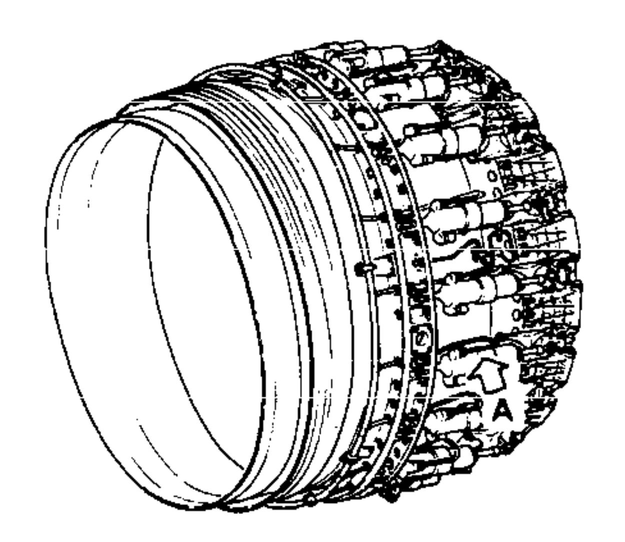
A

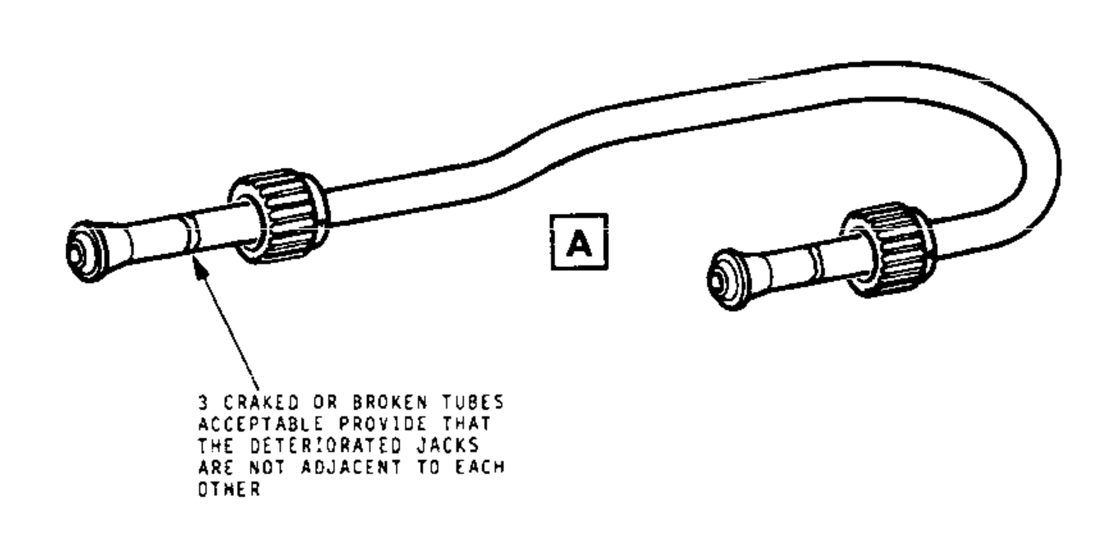
B

CMS 78 12 01 6 DAMO

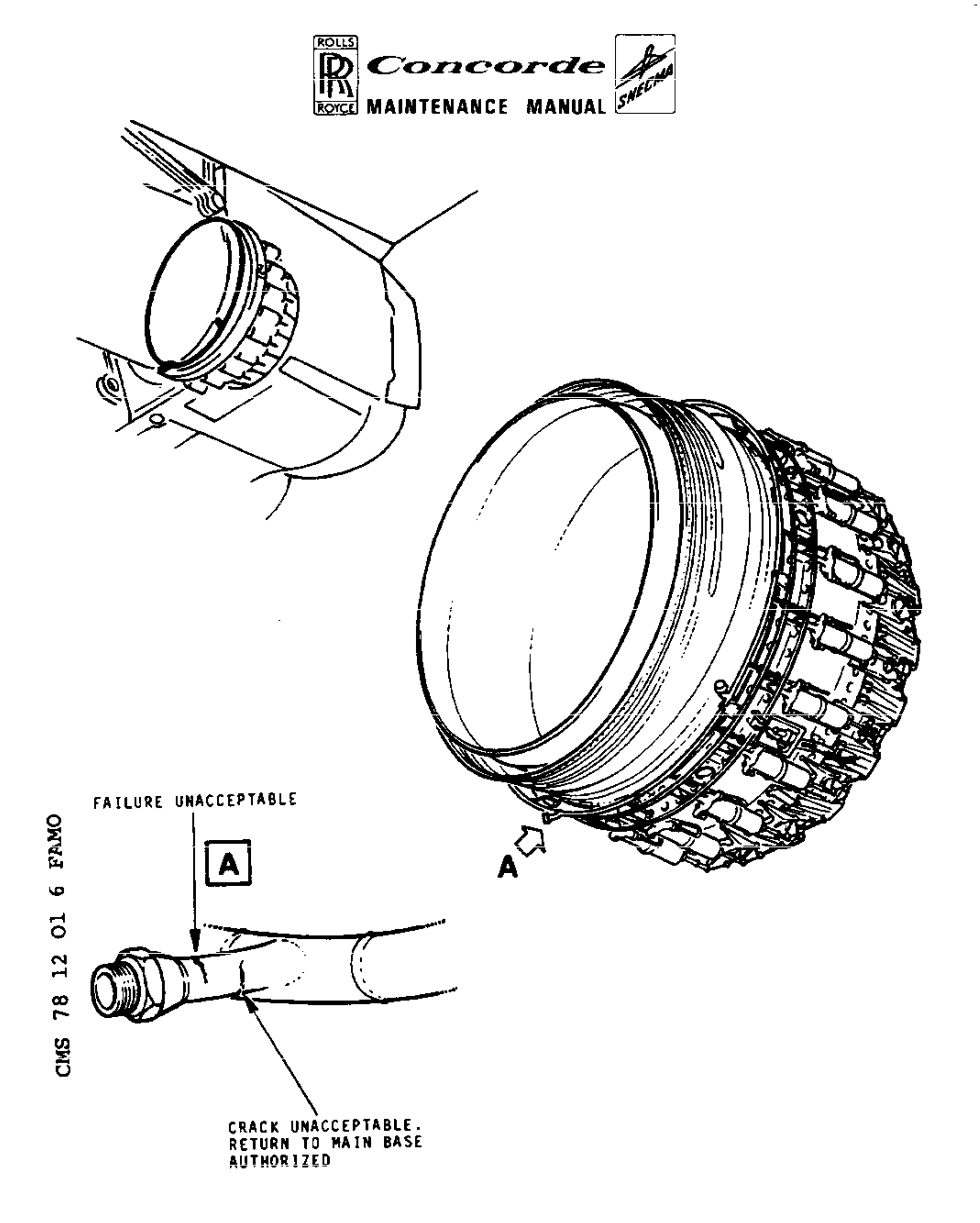
Inspection of Primary Nozzle
Follower Petal Acceptance Criteria
Figure 604

R



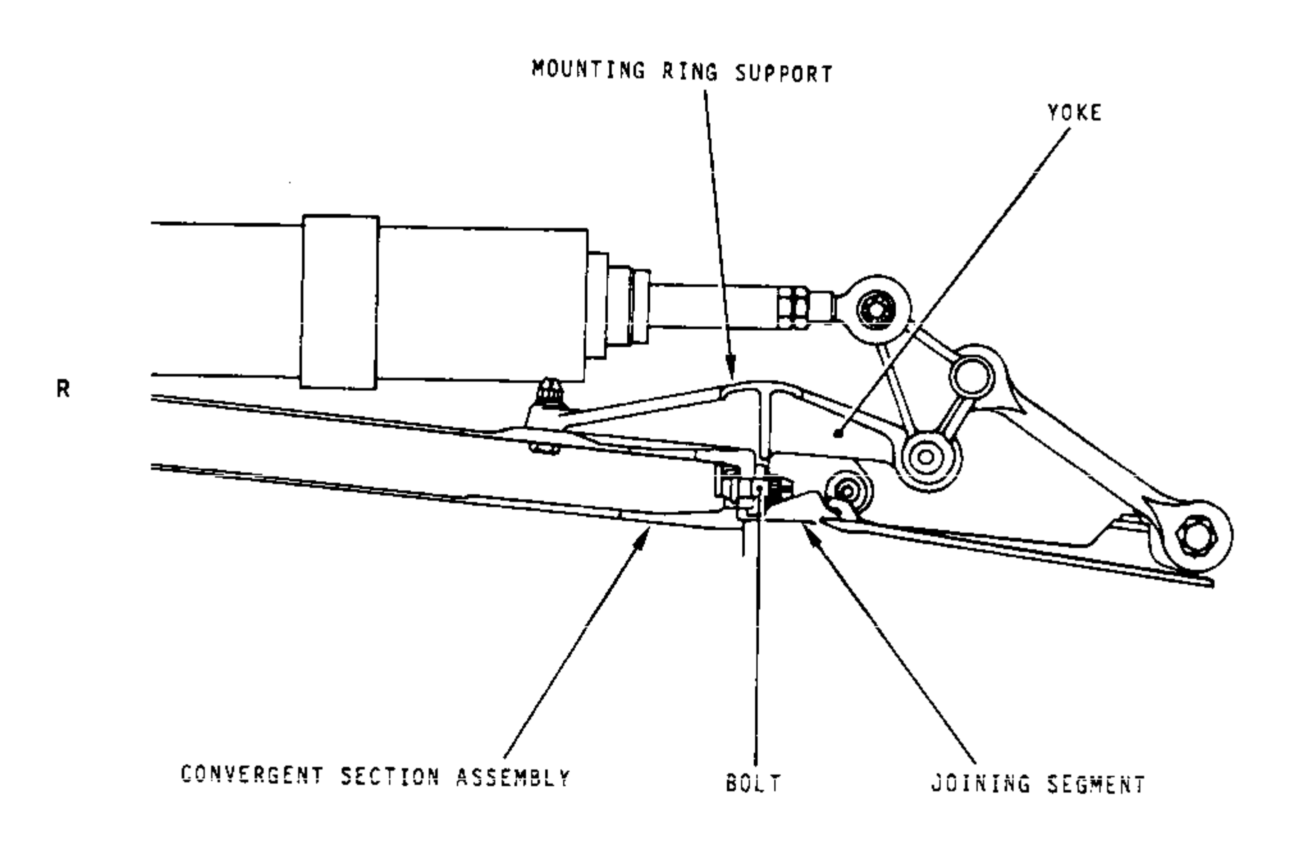


R Jack Air Supply Tube
Figure 605



Inspection of Primary Nozzle
Nozzle Closing Manifold Acceptance Criteria
Figure 606

R



NOTE: 90 PER ASSEMBLY

R Attachment of the Convergent Section and Petal Twin Yokes
R Figure 607

PRIMARY NOZZLE AREA TRANSDUCER - REMOVAL/INSTALLATION

1. General

This topic details the removal/installation of the electric component of the primary nozzle area transducer (Ref.
R paragraph 2) and of its electrical cable (Ref. paragraph
R 3). The removal/installation of the electrical cable
R requires the preliminary removal of the bucket position
R transmitter (indicator).

2. Primary Nozzle Area Transducer

A. Equipment and Materials.

DESCRIPTION	PART NO.
Torque wrench (0 to 3 daN.m in range)	-
Circuit breaker safety clips	-

B. Prepare to Remove Primary Nozzle Area Transducer.

(1) Electrically isolate the engine and exhaust assembly services indicated in Table 401 by tripping the circuit breakers affecting engines in the nacelle upon which work is being carried out. Fit circuit breaker safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINE NO. 1 ENG % AREA (AJ) IND	14-215	1E81	C13
ENGINE NO. 2 ENG % AREA (AJ) IND	13-215	2E81	D13
ENGINE NO. 3 ENG % AREA (AJ) IND	13-216	3E81	B 6
ENGINE NO. 4 ENG % AREA (AJ) IND	14-216	4E81	B 6

Circuit Breakers
Table 401

(2) Display a suitable placard on the engine starting

Printed in England

panel indicating that personnel are working on the engines.

(3) Obtain access to the Primary Nozzle by opening the engine bay rear door (Ref.71-00-00, Servicing).

C. Remove Primary Nozzle Area Transducer (Ref. Fig. 401).

(1) Unlock and disconnect the cable connector from the transducer.

(2) Remove the locking pin (Ref. Detail A), save the grooved washer and the pin.

(3) Remove and save the 12 point head bolts.

(4) Remove the primary nozzle area transducer fitted with its link and protecting plate by pushing it towards the nozzle front so as to free the link from support.

D. Angular Pick-off Removal (Ref. Fig. 402).

(1) Loosen the self-locking nuts.

(2) Remove the angular pick-off.

E. Prepare to Install Primary Nozzle Area Transducer (Ref. Fig. 402).

(1) Position the angular pick-off on the Primary Nozzle Area Transducer.

<u>CAUTION:</u> ENSURE THAT THE DRIVING DOG OF THE ANGULAR PICK-OFF IS CORRECTLY ENGAGED IN THE CONTROL LEVER HOUSING.

(2) Screw the self-locking nuts and torque to 0,55 daN.m (50 lbf. in).

F. Install the Primary Nozzle Area Transducer (Ref. Fig. 401).

(1) Engage the link through the nozzle front end into the support corresponding slot.

(2) Secure the primary nozzle area transducer on its support by means of the self-locking nuts and torque to between 0,95 and 1,05 m.daN (84 to 93 lbf. in). Ensure that the protecting plate is suitably positioned.

(3) Install the link in the yoke and position the pin, the

Printed in England

grooved washer and the locking pin. (Ref.Detail A).

G. Final Installation.

(1) Connect and lock the cable connector on the transducer.

(2) Reset all circuit breakers (Ref. Table 401).

(3) Energize circuit 115V-400 Hz.

(4) Fully close, then open, manually the primary nozzle petals and read the corresponding nozzle area values in the cockpit. These values must be respectively 8 and 91 per cent plus or minus 4 per cent.

CAUTION: ENSURE THAT IN ANY OPEN OR CLOSED POSITION THE TRANSDUCER CONTROL LEVER NEVER INTERFERES WITH THE TRANSDUCER SUPPORT.

(5) Close the engine bay rear door (Ref. 71-00-00, Servicing) and remove the placard displayed on the engine starting panel.

R 3. Electric cable (Ref. Fig.403 and 405)

R A. Equipment and Materials

R DESCRIPTION

R Pneumatic vibration screwdriver
R (preadjusted at 0,60 daN.m, 53 lbf.in.) and the appropriate
R screwdriver head.

R Pneumatic impact wrench (unscrewing mode)
R ARO 8530 Pc 1 and the appropriate screwdriver head.

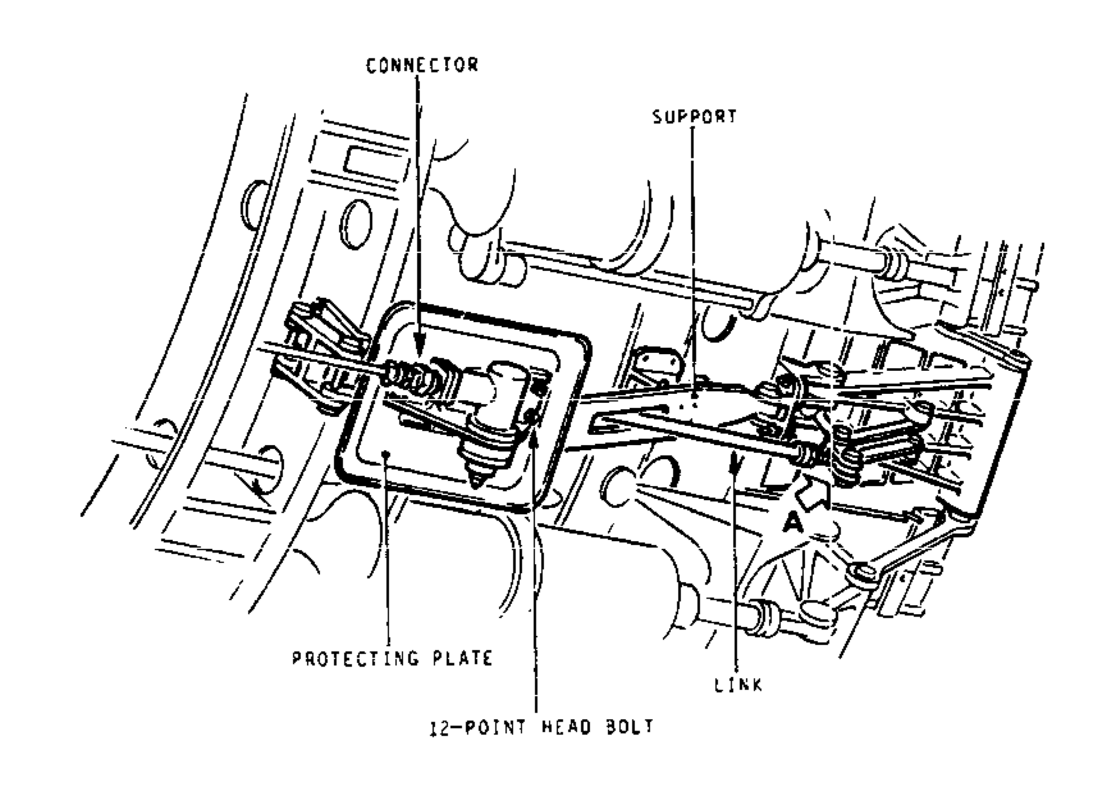
R Torque wrench (0 to 3 daN.m, 0 to 265 lbf.in.)

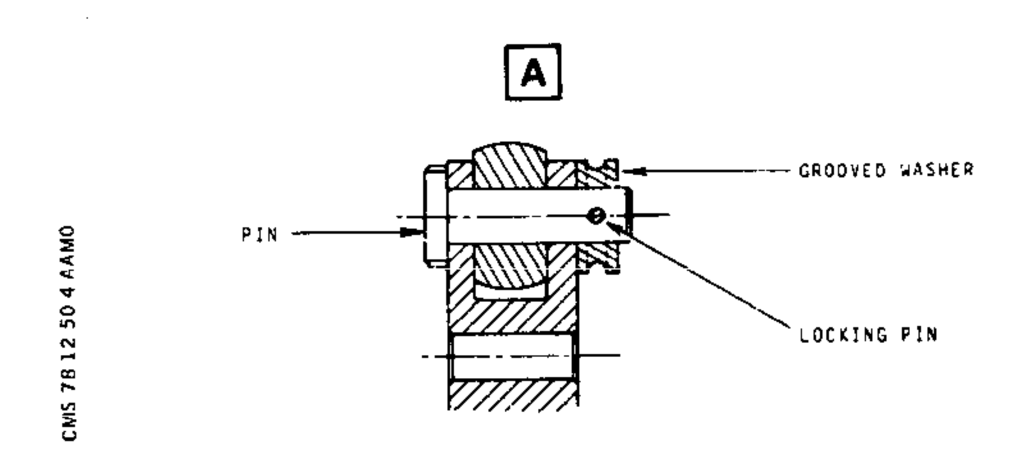
R Circuit breaker safety clips.

R B. Prepare to Remove the Electric Cable

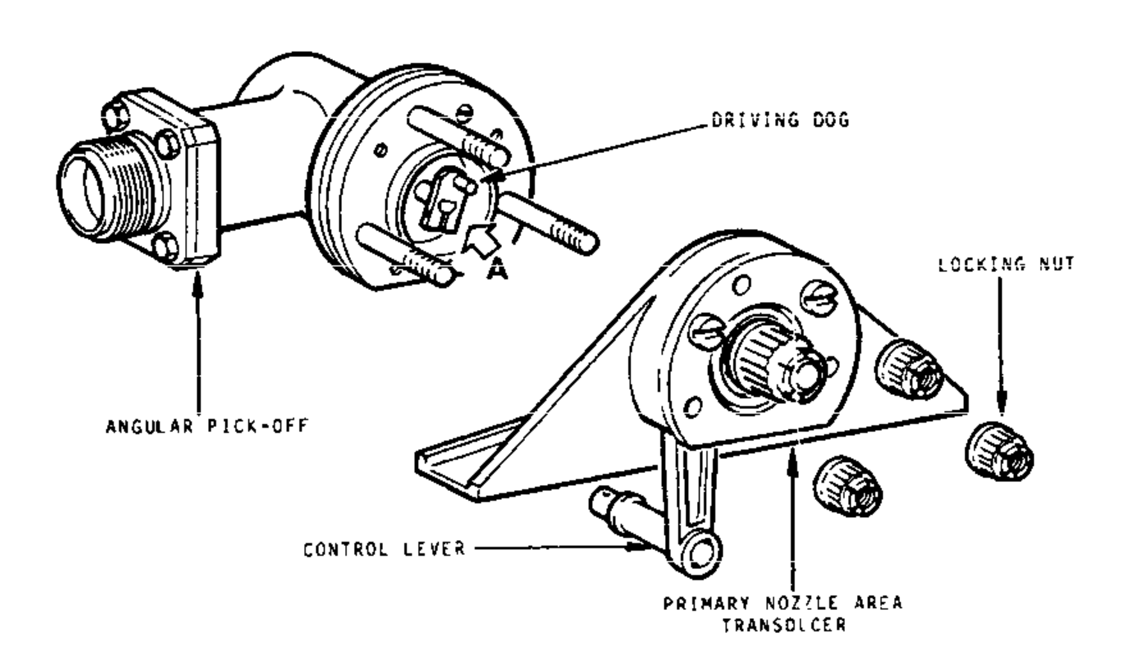
R (1) Electrically isolate the engine and exhaust assembly
R services indicated in Table 401 by tripping the cir-
R cuit breakers affecting engines in the nacelle upon
R which work is being carried out. Fit circuit breaker
R safety clips.

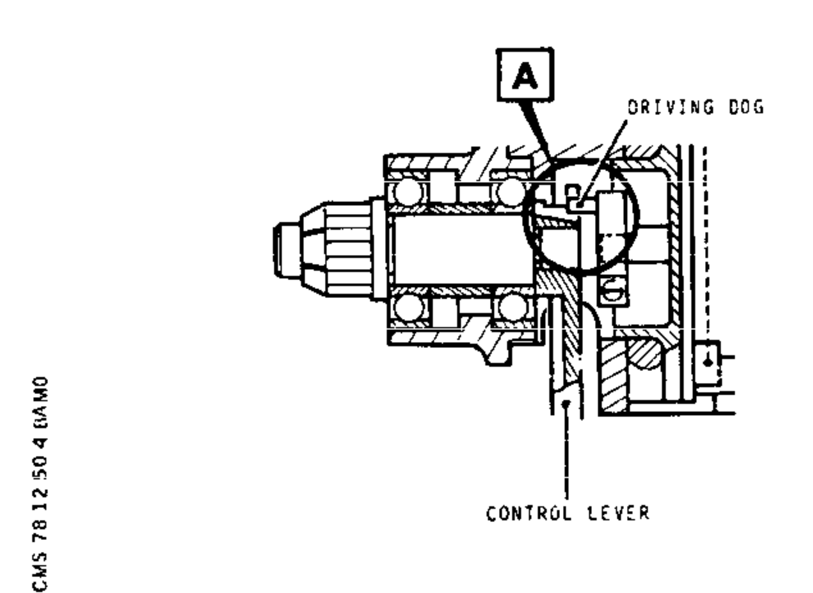
R WARNING : MAKE SURE THAT NO SOURCE OF COMPRESSED AIR
R IS CONNECTED TO THE GROUND CONNECTIONS OF





Primary Nozzle Area Transducer Removal
Figure 401





CMS 78 12 50 4 BAMO

Primary Nozzle Area Transducer Installation
Figure 402

R THE TWIN SECONDARY NOZZLE ON WHICH REMOVAL
R IS CARRIED OUT.

R (2) Display a suitable placard on the engine starting
R panel, indicating that personnel are working on the
R engine and TWIN SECONDARY NOZZLE area.

R (3) Obtain access to the Primary Nozzle by opening the
R engine bay rear door (Ref. 71-00-00, Servicing).

R (4) Remove the bucket position transmitter (indicator)
R (Ref. 78-35-01, Removal/Installation).

R (5) Using a pneumatic impact wrench equipped with an
R appropriate screwdriver head, remove the respective
R access panels to the lower lateral and central bucket
R Ballscrew Gearboxes (Ref. Fig. 403).

R CAUTION : USE APPROPRIATE TOOLS AND PAY SPECIAL ATTEN-
R TION TO THE TYPE AND CONDITION OF THE SCREW-
R DRIVER HEAD. USING MANUAL OR INAPPROPRIATE
R TOOLS COULD ONLY LEAD TO THE DETERIORATION
R OF THE SCREWS.

R C. Removal of the Electric Cable

R (1) Unlock and disconnect the cable connector from the
R transducer (Ref. Fig. 403).

R (2) Inside the bay unscrew hexagonal head bolts securing
R the two half-clamps on the structure
R (Ref. Fig.403 and 405)

R (3) Remove the two half-clamps.

R (4) At the Bucket Position Transmitter (indicator) loca-
R tion, unscrew the self locking nuts and bolts and
R remove the seven clips securing the electrical cable
R (Ref. Fig. 403).

R (5) Unscrew the two attachment bolts and washers securing
R the gutter unit on the Bucket Position Transmitter
R (indicator) spherical bearing mounting assembly
R (Ref. Fig. 403).

R (6) In the central bucket ballscrew gearbox housing un-
R screw the self-locking nuts and bolts and remove the
R two clips securing the electric cable (Ref. Fig. 405)

R (7) On the front framework, unlock and disconnect the
R cable connector located on the structure

R (Ref. Fig. 405).

R (8) Unscrew hexagonal head bolts, unlock and unscrew cy-
R lindrical head bolts, them remove square spacer and
R square plate which secure the fixed connector to the
R front frame (Ref. Fig.404 and 405).

R (9) Carefully withdraw the primary nozzle area transducer
R cable from the structure.

R (10) Fit blanks to the electrical wiring connectors.

R (11) On the cable, unscrew the self locking nut and bolt
R and remove the clip securing the gutter unit to the
R cable (Ref. Fig. 404).

R (12) Remove the gutter unit from the cable and remove the
R sheath.

R D. Installation of the Electrical Cable

R (1) Position square plate to the fixed connector using the
R screws and the square spacer. Torque-tighten the
R screws between 0,30 and 0,40 daN.m (2.21 to 2.95 lbf.
R ft). Wire-lock screws in pairs (Ref. Fig.404 and 405)
R detail B).

R (2) Carefully introduce the cable into the passage hole in
R the front framework, and position the cable in the
R structure (Ref. Fig.403 and 405).

R (3) Connect the cable connector to the primary nozzle area
R transducer (Ref. Fig. 403).

R (4) Inside the bay secure one of the half-clamps, using
R hexagonal head bolts fitted with washers
R (Ref. Fig.403 and 404).

R (5) Position the cable in the half-clamp at the location
R where a protective sleeve is crimped on the cable
R sheath (Ref. Fig.403 and 404).

R (6) Position the other half-clamp and secure it to the
R structure using hexagonal head bolts and washers
R (Ref. Fig. 404).

R (7) Secure the half-clamps together, using hexagonal
R bolts, washers and nuts (Ref. Fig.403 and 404).

R (8) Torque-tighten each bolt on the half-clamps between

A

B

A

ELECTRICAL
CABLE

AREA TRANSDUCER

STRUCTURE

CABLE

C

SPACER - IF REQUIRED TO
ENSURE 5 mm (0.195 in.)
CLEARANCE BETWEEN HARNESS
AND HOLE EDGE.

B

BUCKET POSITION
TRANSMITTER

C

CLIPS

ATTACHMENT
BOLTS

SPHERICAL BEARING
MOUNTING ASSEMBLY

CLIPS

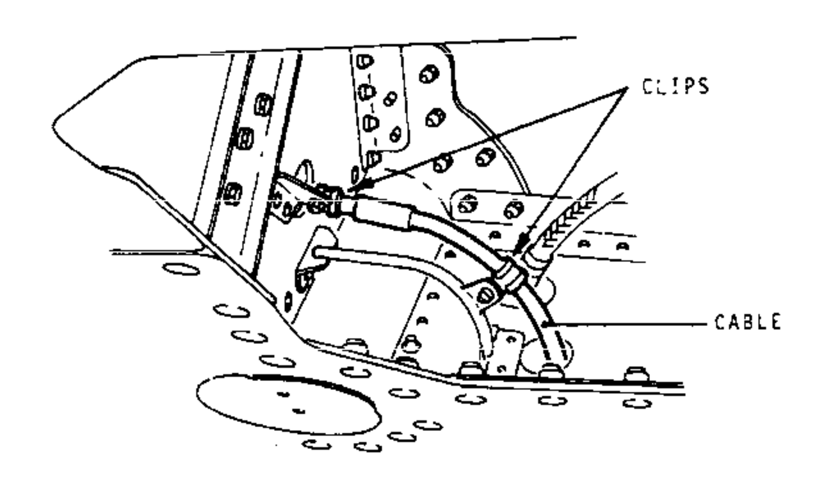
FORWARD

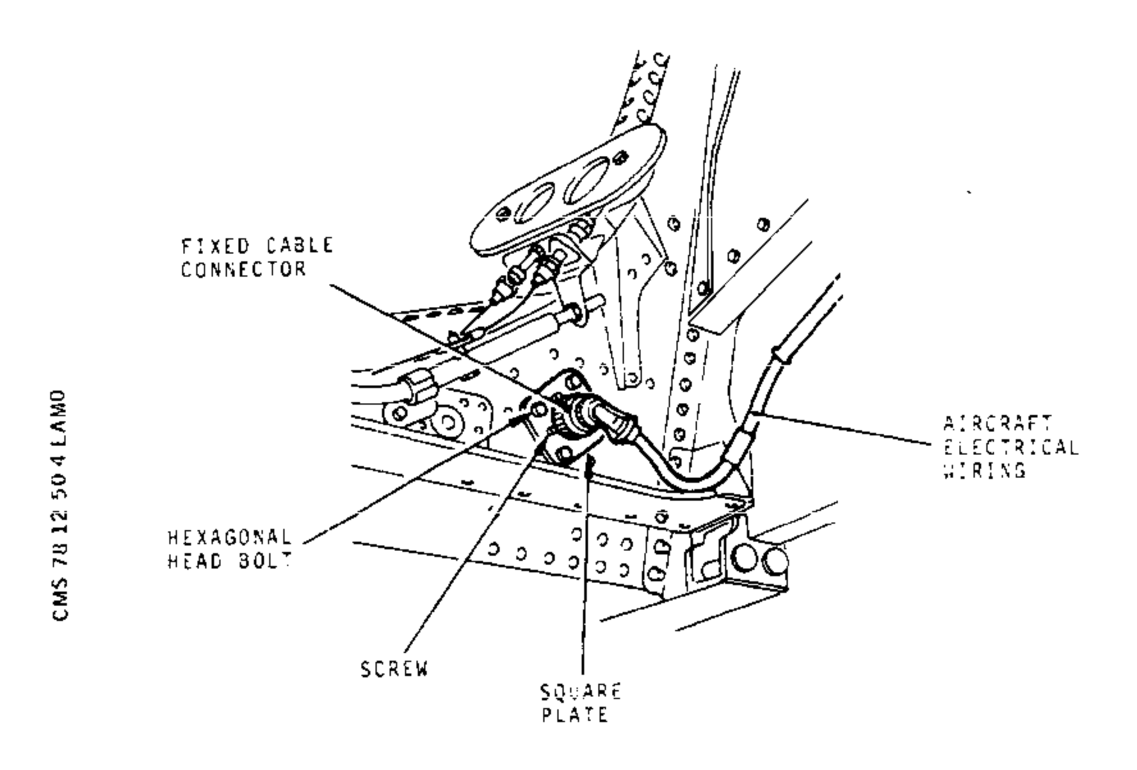
CMS 78 12 50 4 CAMO

Electrical Cable (Primary Nozzle Area
Transducer)
Figure 403

A
B
C
B
SHEATH
GUTTER
HEXAGONAL HEAD BOLT
A
HEXAGONAL HEAD BOLTS
HALF-CLAMPS
C
SCREW
SQUARE SPACER
SQUARE PLATE
HEXAGONAL HEAD BOLT
CMS 78 12 50 4 DAMO

R Removal installation
Figure 404





Removal installation
R Figure 405

0,30 to 0,40 daN.m (2.21 to 2.95 lbf.ft).

(9) On the front frame, secure the fixed connector. Torque tighten the hexagonal head bolts between 0,30 to 0,40 daN.m (2.21 to 2.95 lbf.ft) (Ref. Fig. 405).

NOTE : When securing the fixed connector to the nozzle front frame, ensure that the locating lug of the connector is directed towards the upper part of the structure.

(10) Connect the aircraft wiring electrical connector to the fixed connector (Ref. Fig. 405).

(11) At the bucket position transmitter (indicator) location

(a) Secure the cable by installing the closest clip to the structure wall.
Torque-tighten the self-locking hexagonal bolt and nut between 0.30 and 0,40 daN.m (2.21 to 2.95 lbf.ft) (Ref. Fig. 403).

NOTE : Ensure that the clip is correctly positioned on the ring crimped to the cable sheath and check the clearance existing between the cable and the edge of the wall penetration hole.

If this clearance is less than 5mm, carry out the following operations.

1 Unscrew and remove the self-locking hexagonal bolt and nut.

2 Place a washer (Ref. 78-13-01 MAINT IPC fig item 28-115) between the clip and the structure.

3 Install a new bolt (Ref. 78-13-01 MAINT IPC fig item 28=105) washer and self=locking nut.

(b) Level with the bucket position transmitter (indicator) the cable passes through a gutter which is secured to the transmitter (indicator) front spherical bearing mounting assembly by two bolts (Ref. Fig. 403).
Pending mounting of the gutter during installation of the bucket position transmitter (indicator) position the gutter to the cable. Install the sheath and slightly tighten the gutter unit

clip, using bolt, washer and self-locking nut (Ref. Fig. 404).

The gutter will be finally positioned, and the nut finally tightened when the transmitter (indicator) is installed.

(c) On each side of the gutter, secure the electric cable using two clips, round head bolts, plain washers and self-locking nuts. Torque-tighten the bolts between 0,30 and 0,40 daN.m (2.21 to 2.95 lbf.ft) (Ref. Fig. 403).

(d) Secure the cable using four clips. Torque-tighten hexagonal head bolts and self-locking nuts between 0,30 to 0,40 daN.m (2.21 to 2.95 lbf.ft) (Ref. Fig. 403).

(12) In the central bucket ballscrew gearbox recess

(a) Secure the electric cable using two clips ; torque-tighten the hexagonal head bolts and self-locking nuts between 0,30 to 0,40 daN.m (2.21 to 2.95 lbf.ft) (Ref. Fig. 405).

(b) Ensure that the electric cable main plate, located close to the last clip before the fixed connector is not obscured by the clip.

(13) Ensure that the electric cable is correctly run and that it has no pronounced kinks or abnormal strains.

(14) Install the bucket position transmitter (indicator) (Ref. 78-35-01, Removal/Installation).

E. Final Installation

(1) Reset all circuit breakers (Ref. Table 401).

(2) Fully close, then open, manually the primary nozzle petals and read the corresponding nozzle area values in the cockpit. These values must be respectively 8 and 91 per cent plus or minus 4 per cent.

(3) Lock the connectors on the primary nozzle area transducer and on the aircraft wiring.

(4) Install the respective access panels to the lower lateral and central bucket ballscrew gearboxes.

(5) Torque the attaching screws to 0,60 daN.m (53 lbf.in.)

R using a pneumatic vibration screwdriver preadjusted at
R the required torque value and equipped with an appro-
R priate screwdriver head.

R <u>CAUTION</u> : USE APPROPRIATE TOOLS AND PAY SPECIAL ATTEN-
R TION TO THE TYPE AND CONDITION OF THE SCREW-
R DRIVER.

R (6) Close the engine bay rear door (Ref. 71-00-00, Servi-
R cing) and remove the placard displayed on the engine
R starting panel.

PRIMARY NOZZLE AREA TRANSDUCER - ADJUSTMENT/TEST

1. General.

   This chapter gives all the information necessary to perform final adjustment of the primary nozzle area transducer, the initial adjustment being normally done at shop level when primary nozzle is overhauled.

2. Primary Nozzle Area Transducer Adjustment/Test. (Refer to figure 501).

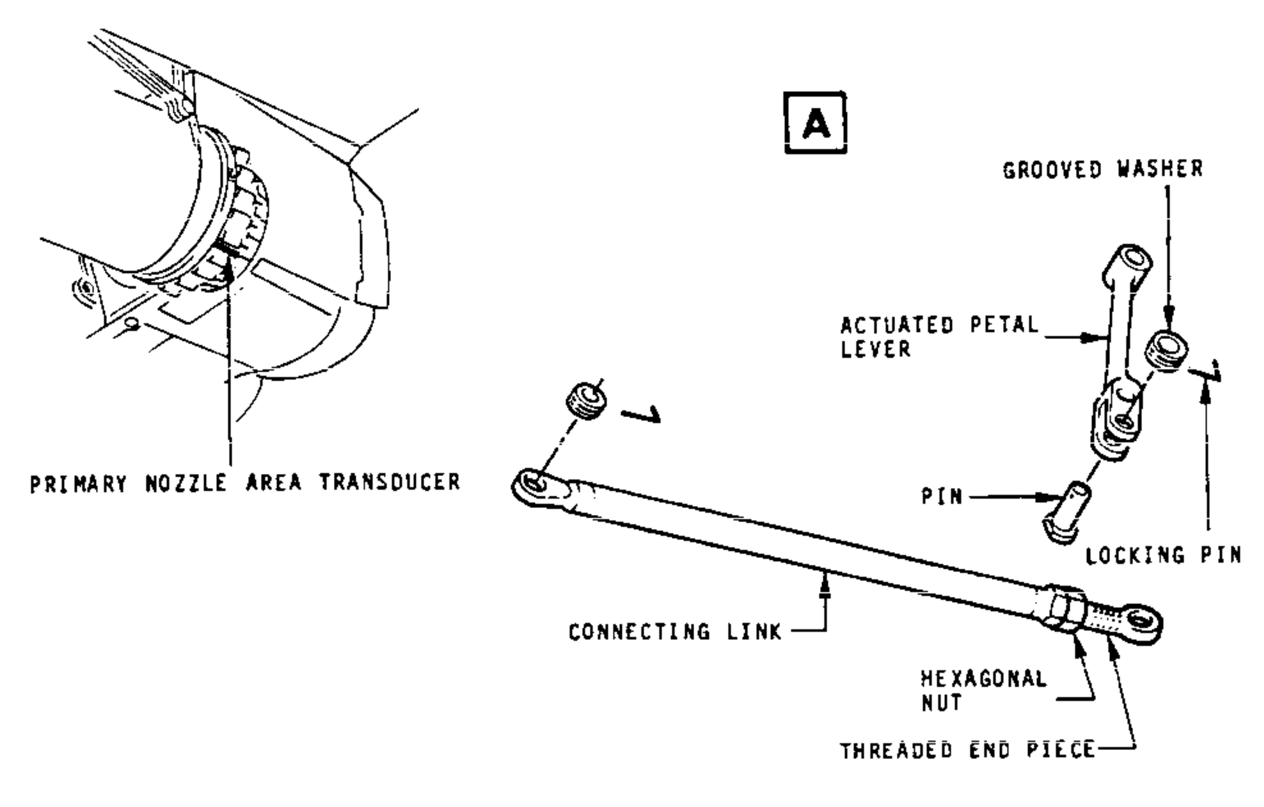
   A. Equipment and Materials.

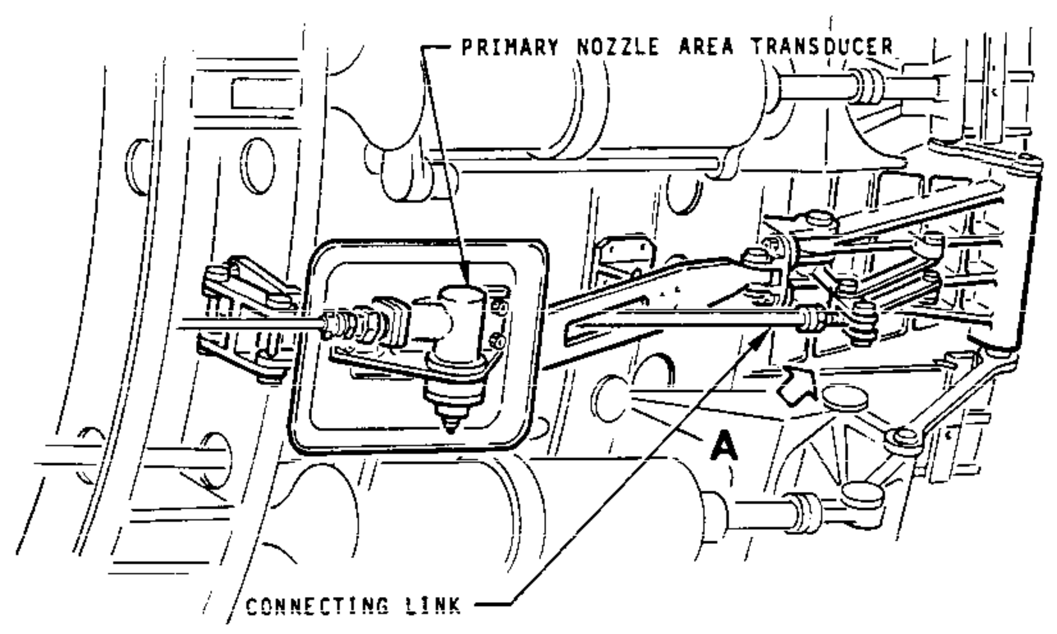
      Circuit breaker safety clip.
      Torque wrench (0 to 3 daN.m - 0 to 265 lb in. range).

   B. Prepare to adjust primary nozzle area transducer.

      WARNING: ACCESS TO THE PRIMARY NOZZLE AREA BEING GAINED THROUGH THE TWIN SECONDARY NOZZLE, MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTORS OF THE SECONDARY NOZZLE ON WHICH THE ADJUSTMENT IS BEING CARRIED OUT.

      (1) Electrically isolate the engine and exhaust assembly services as indicated in table 501 by tripping the circuit breakers affecting engine in the nacelle upon which work is being carried out. Install circuit breaker safety clips.





Primary Nozzle Area Transducer Adjustment/Test
Figure 501

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENGINE No.1			
BUCKET CONT UNIT SUP	14-215	1K1132	E 12
REV THRUST CONT	3-213	1K331	D 1
ENGINE No.2			
BUCKET CONT UNIT SUP	13-215	2K1132	G 14
REV THRUST CONT	1-213	2K331	B 5
ENGINE No.3			
BUCKET CONT UNIT SUP	13-216	3K1132	C 6
REV THRUST CONT	1-213	3K331	B 6
ENGINE No.4			
BUCKET CONT UNIT SUP	14-216	4K1132	C 6
REV THRUST CONT	3-213	4K331	D 2

Circuit Breakers
Table 501

(2) Display a suitable placard on the engine starting panel indicating that personnel are working on the engine and in the twin secondary nozzle.

C. Adjustment of the primary nozzle area transducer.

(1) Gain access to the primary nozzle area transducer located at the bottom of the primary nozzle (7 o'clock bay 1 and 3, 5 o'clock bay 2 and 4).

<u>CAUTION:</u> BEFORE CARRYING OUT ANY WORK, LINE SECONDARY NOZZLE WITH RUBBER CARPETS TO AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES MUST ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

(2) Position the primary nozzle fully closed to allow access to the connecting link end-piece.

(3) Cut the lock-wire and loosen the hexagonal nut securing the threaded end fitting.

(4) Remove the locking pin and remove the grooved washer and pin securing the connecting link to the actuated petal lever.

(5) Adjust the length of the connecting link by screwing or unscrewing the threaded end piece in order to obtain the correct readings.

- Primary nozzle fully closed AJ=8% ± 4

- Primary nozzle fully open AJ = 91% ± 4

(6) Temporary secure the connecting link to the actuated petal lever and check that both indications at the OPEN and CLOSE position are meeting the required AJ indication band. Repeat adjustment if necessary.

(7) Finalize installation of the locking pin in the grooved washer securing the connecting link to the actuated petal lever.

(8) Tighten the hexagonal nut to the prescribed torque (0.6/0.8 daN.m - 4.4/5.9 lbf. ft) and wire-lock.

D. Conclusion.

(1) Check that the primary nozzle is positioned in the fully open position.

(2) Remove circuit breaker safety clips and reset circuit breaker (refer to table 501).

R PRIMARY NOZZLE AREA (AJ) INDICATOR - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Four AREA indicators are mounted at the bottom of the dashboard centre instrument panel 6-211. As the indicators are identical the removal/installation instructions detailed for one indicator are applicable to all four, the reference to No. 1,2,3 or 4 being for the indicator in a particular engine (No.1,2,3 or 4) system.

2. Indicator

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

B. Prepare to Remove

(1) Electrically isolate the indicator to be removed by tripping the appropriate circuit breaker; fit a safety clip.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINE 1			
ENG 1 % AREA (AJ) IND	14-215	1E81	C12
ENG 1 PP MGT LTS SUP	5-213	1E461	D 1
ENG 1 REHEAT AMP SUP	14-215	1K1541	C12
ENG 1 REHEAT CONT	15-216	1K1542	E 9
PLT'S LT TEST SUP	15-215	L1001	E14
CTR DASH & G/SHIELD INST LTS SUP	14-216	L375	D10
ENGINE 2			
ENG 2 % AREA (AJ) IND	13-215	2E81	E14
ENG 2 PP MGT LTS SUP	1-213	2E461	E 3
ENG 2 REHEAT AMP SUP	13-215	2K1541	B14
ENG 2 REHEAT CONT	15-215	2K1542	D15

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
PLT'S LT TEST SUP	15-215	L1001	E14
CTR DASH & G/SHIELD INST LTS SUP	14-216	L375	D10
ENGINE 3			
ENG 3 % AREA (AJ) IND	13-216	3E81	B 5
ENG 3 PP MGT LTS SUP	1-213	3E461	E 4
ENG 3 REHEAT AMP SUP	13-215	3K1541	B 7
ENG 3 REHEAT CONT	15-215	3K1542	D16
PLT'S LT TEST SUP	15-215	L1001	E14
CTR DASH & G/SHIELD INST LTS SUP	14-216	L375	D10
ENGINE 4			
ENG 4 % AREA (AJ) IND	14-216	4E81	B 5
ENG 4 PP MGT LTS SUP	5-213	4E461	D 2
ENG 4 REHEAT AMP SUP	14-216	4K1541	D 7
ENG 4 REHEAT CONT	15-216	4K1542	E10
PLT'S LT TEST SUP	15-215	L1001	E14
CTR DASH & G/SHIELD INST LTS SUP	14-216	L375	D10

B. Remove

NOTE: The rear panel-mounted indicator electrical connector is spring-loaded, exerting a forward pressure of approximately 10 lbf (4.54 Kg) on the indicator.

(1) Hold the face of the indicator firmly toward the instrument panel.

(2) Loosen the adapter plate securing screws, then with the indicator still held firmly toward the panel, remove the screws and adapter plate.

After SB 77-001 For A/C 001-007,

Loosen the adapter plate securing screws, then with the indicator held firmly toward the panel, remove the screws and the adapter plate and colour sector plates.

(3) Gradually release the pressure on the indicator, which will be forced approximately 0.5 in (12 mm) out of its panel aperture by spring pressure.

(4) Carefully withdraw the indicator from the panel.

NOTE: The indicator must be supported as it is withdrawn, to allow for the extra weight when the electrical connector and locating spigot are disengaged.

C. Prepare to Install

(1) Check that the electrical connector on the instrument is clean and undamaged.

D. Install Indicator

(1) Comply with the electrical safety precautions.

(2) Position the indicator in the panel aperture.

(3) Align the instrument case horizontally and engage the locating spigot.

(4) Position the adapter plate on the indicator face, then gently but firmly engage the electrical connector and press the indicator fully into engagement.

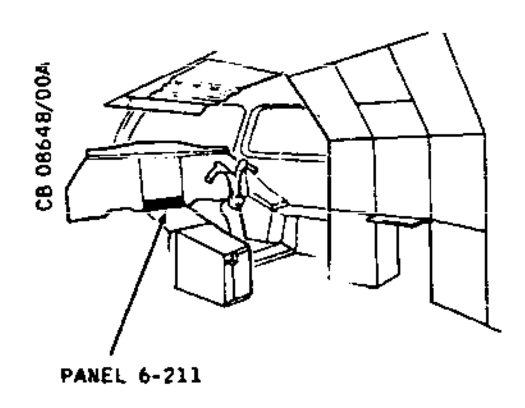
After SB 77-001 For A/C 001-007,

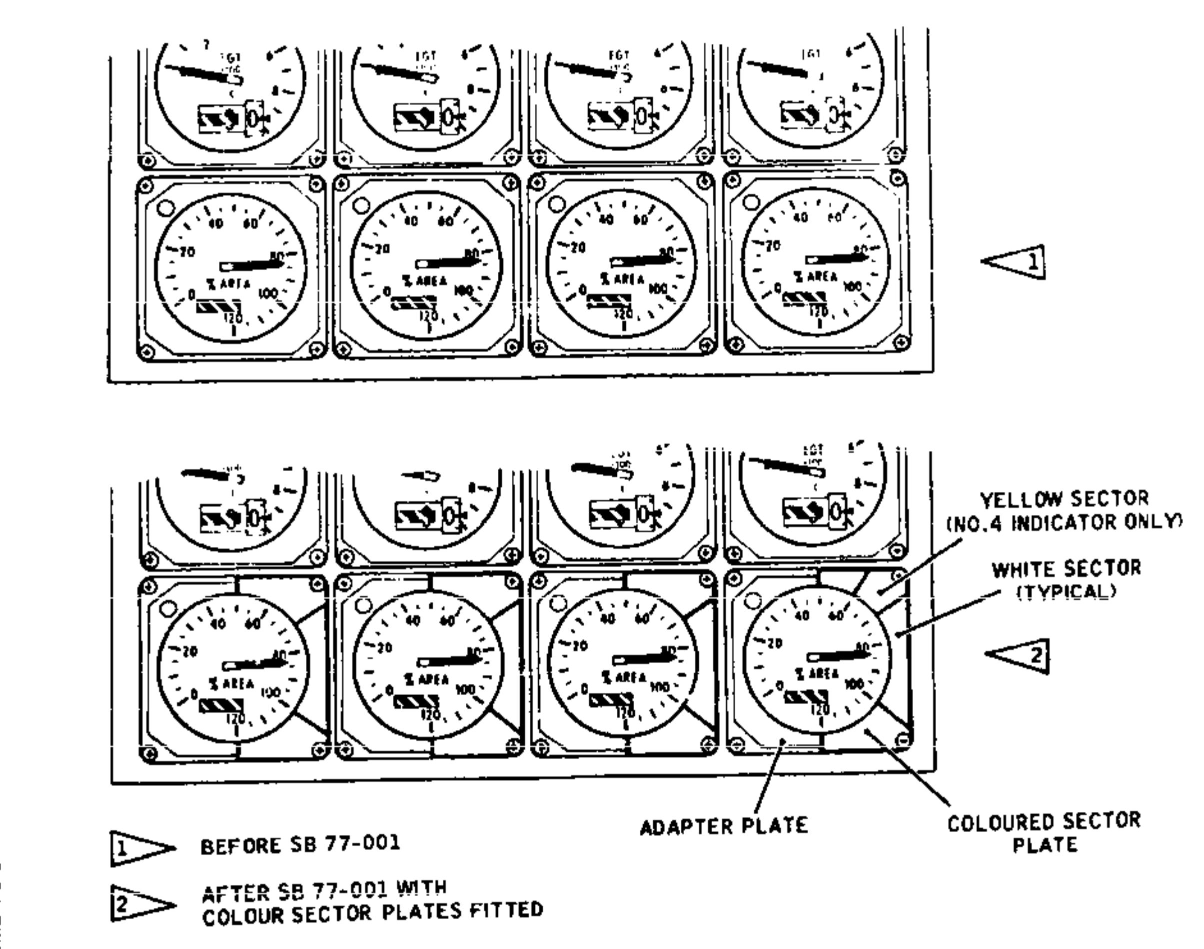
(5) Maintain hand pressure on the indicator and secure the adapter plate with the screws.

Ensure that the ends of the white sector on the coloured sector plates correspond with indicator scale marks 70 and 100 per cent. On No.4 indicator, ensure also that the ends of the yellow sector correspond with indicator scale marks 60 and 70 per cent.

(6) Remove the safety clips and reset the circuit breakers previously tripped.

(7) Operationally test the indicator (Ref. 78-12-51, Adjustment/Test).





R Area Indicators - Installation
Figure 401

PRIMARY NOZZLE (AJ) INDICATOR - ADJUSTMENT/TEST

WARNING: OBSERVE THE INSTRUCTIONS FOR ENTERING THE NOZZLE/JET PIPE GIVEN IN 71-00-00 SERVICING, BUT AN ELECTRICAL SUPPLY TO THE AJ INDICATORS IS NECESSARY TO PERFORM THIS TEST.

CAUTION: INSIDE THE JET PIPE TAKE CARE NOT TO DAMAGE PROBES, SENSORS AND FITTINGS, IN PARTICULAR DO NOT USE THESE ITEMS AS HANDHOLDS.

1. General

Four AJ indicators are located on the lower part of the pilots' dashboard centre instrument panel, 6-2-11. An operational test can be carried out separately on the indicators associated with each engine. To carry out the test, it is necessary for one person to enter the engine exhaust and move the petals of the primary nozzle by hand, while another person monitors the indicator.

2. Operational Test

A. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

B. Test

(1) Check that the four AJ indicator failure warning flags are withdrawn, and the dial pointers indicate the primary nozzle positions (approximately the same indicated position for each engine).

(2) Enter the No.1 twin secondary nozzle (Ref. 71-00-00, Servicing) to gain access to the engine primary nozzle and close the petals fully by manual pressure. Check that the corresponding AJ indicator reads less than 12 per cent.

(3) Open the petals fully by manual pressure and check that the AJ indicator reads approximately 90 per cent.

(4) Repeat operations (2) and (3) on engines 2, 3 and 4 for other indicators as required.

(5) Switch off electrical ground power and check that the AJ indicator(s) read less than 12 per cent and that the failure flag(s) appear in the counter aperture(s).

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END OF THIS SECTION

NEXT

TWIN SECONDARY NOZZLE - REMOVAL AND INSTALLATION

1. General

This chapter deals with the precautions to be taken during removal and installation of the twin secondary nozzle access doors and panels fitting screws.

R CAUTION: BEFORE CARRYING OUT ANY WORK, THE SECONDARY
R NOZZLE MUST BE LINED WITH RUBBER CARPETS
R TO AVOID DAMAGE RESULTING FROM ACCIDENTAL
R BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES
R MUST ALSO BE WORN WHEN STEPPING ON THE
R NOZZLE.

2. Equipment and Materials

DESCRIPTION	PART NO.
Pneumatic impact wrench (unscrewing mode) ARO 8530 PC1 and the appropriate screwdriver head. Pneumatic vibration screwdriver (preadjusted at 0.60 daN.m = 53 lbf.in.) and the appropriate screwdriver head.	

3. Access Door Removal/Installation

A. Access Door Removal

(1) Check that the impact screwdriver rate of impact is adjusted at an intermediate speed. To this end, actuate the rate of impact adjustment screw (Ref. Fig. 401).

(2) Check that no extraneous material clogs the screws recesses. Clean if required.

(3) Remove the access door, using a preumatic impact wrench equipped with an appropriate screwdriver head. Remove the screws by applying the greatest possible axial load on the screwdriver by carefully following the screw axis.

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE

SCREWDRIVER HEAD.
USING MANUAL OR UNAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

B. Prepare to Install the Access Door

Discard all screws featuring defects such as those specified on the illustration (Ref. Fig. 401).

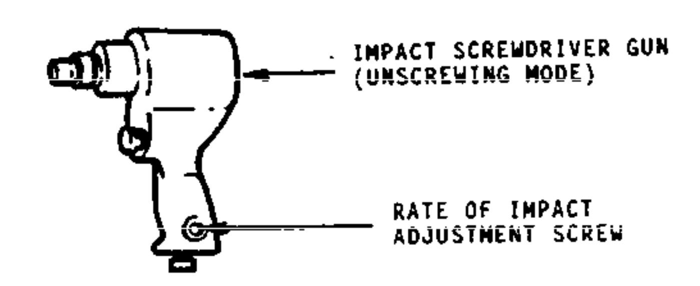
NOTE: No lubricant shall be applied on screws and nuts prior to assembly.

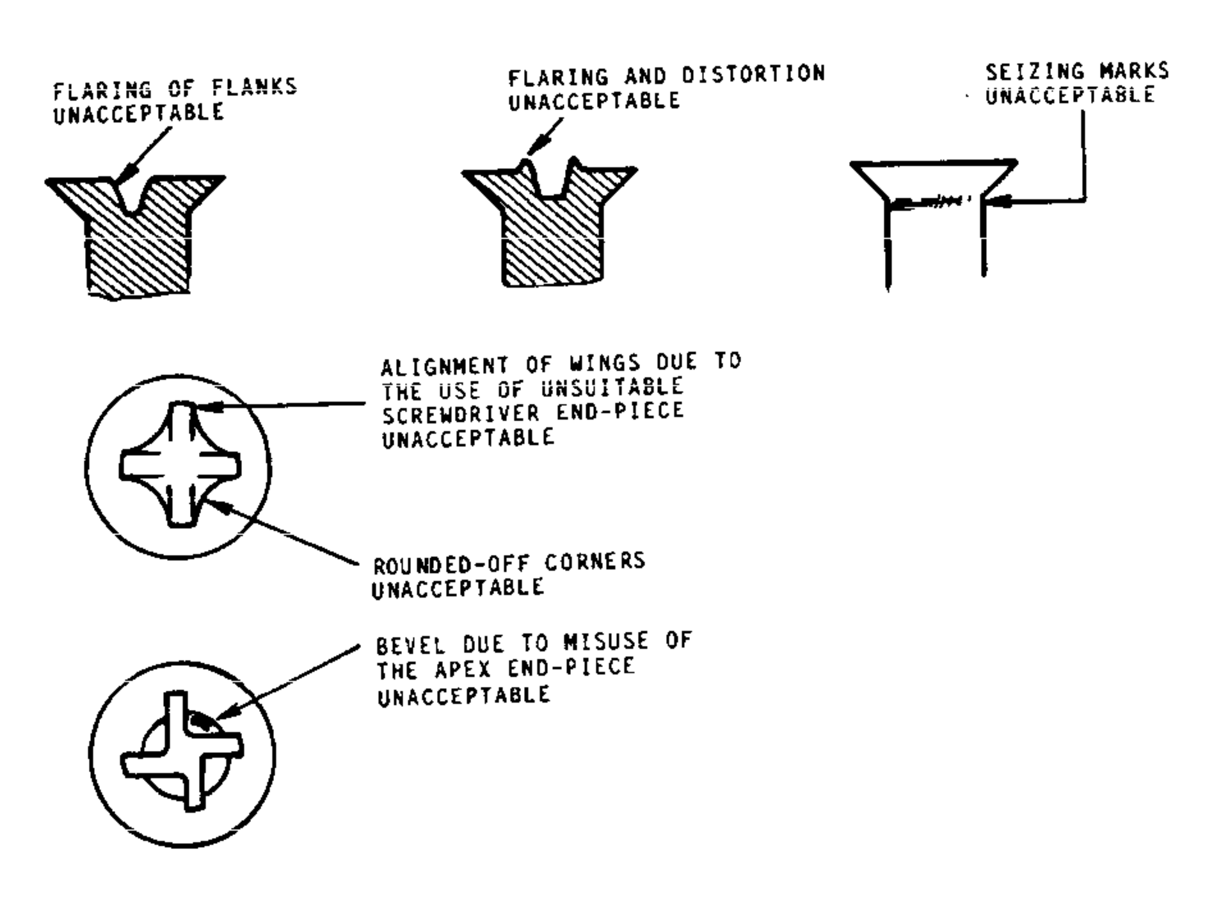
C. Install the Access Door

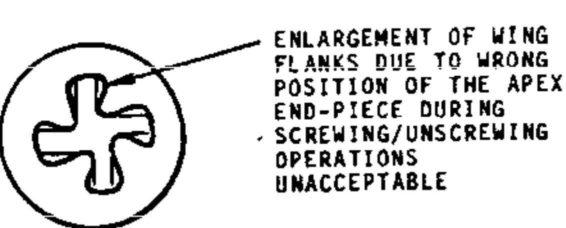
Install the access door and the relevant fitting screws. Torque the screws to 0.60 daN.m (53 lbf.in.) using a pneumatic vibration screwdriver pre-adjusted at the required torquing value.

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD. USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

NOTE: Take care to apply the greatest possible axial load on the screwdriver by carefully following the screw axis.







CMS 78 13 01 4 AAM0

Twin Secondary Nozzle Access Doors
- Removal/Installation
Figure 401

TWIN SECONDARY NOZZLE - INSPECTION/CHECK

1. General

R This chapter defines the inspection methods and some of the
R procedures to be followed during examination of the Twin
R Secondary Nozzle and gives the associated acceptance
R criteria related to damage affecting the secondary nozzle.

R Visual examination and an aural check (tap coin test) are
R generally used to inspect the secondary nozzle, tap coin
R test being used when checking for integrity of the honeycomb
R panels.

R When access to a particular area is difficult or when other
R examination techniques prove to be inadequate boroscopic
R examination should be used.

CAUTION: BEFORE CARRYING OUT ANY WORK, THE SECONDARY NOZZLE MUST BE LINED WITH RUBBER CARPETS TO AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES MUST ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

2. Prepare Twin Secondary Nozzle for Examination

A. Electrically isolate the engine and exhaust assembly services indicated in Table 601 by tripping the circuit breakers affecting engines in the nacelle upon which work is being carried out. Fit circuit breakers safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENGINE NO.1			
BUCKET CONT UNIT SUP	14-215	1K1132	E12
REV THRUST CONT	3-213	1K331	D 1
ENGINE NO.2			
BUCKET CONT UNIT SUP	13-215	2K1132	G14
REV THRUST CONT	1-213	2K331	B 5
ENGINE NO.3			
BUCKET CONT UNIT SUP	13-216	3K1132	C 6
REV THRUST CONT	1-213	3K331	B 6
ENGINE NO.4			
BUCKET CONT UNIT SUP	14-216	4K1132	C 6

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
REV THRUST CONT	3-213	4K331	D 2

Circuit breakers
Table 601

WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE.

B. Display a suitable placard on the engine starting panel indicating that personnel are working on the engines and in the twin secondary nozzle area.

3. Visual Examination of the Twin Secondary Nozzle
(Ref. Fig. 601, 602 and 603)
(Ref. Fig. 604, 605 and 606)
(Ref. Fig. 607, 608 and 609)
(Ref. Fig. 610, 611 and 612)
(Ref. Fig. 613, 614 and 615)
R (Ref. Fig. 616, 617 and 618)

A. Examine the Twin Secondary Nozzle

(1) Visual check of twin secondary nozzle for damage.

NOTE: Certain defects will not be visible unless the twin secondary nozzle is entirely or partially disassembled.

B. Acceptance Criteria

(1) Compare twin secondary nozzle damage with the criteria specified on the appropriate series of illustration sheets.

(2) If a damage exceeds the specified dimensions, reject the component for rectification.

4. Aural Check (Tap Coin Test) of the Twin Secondary Nozzle

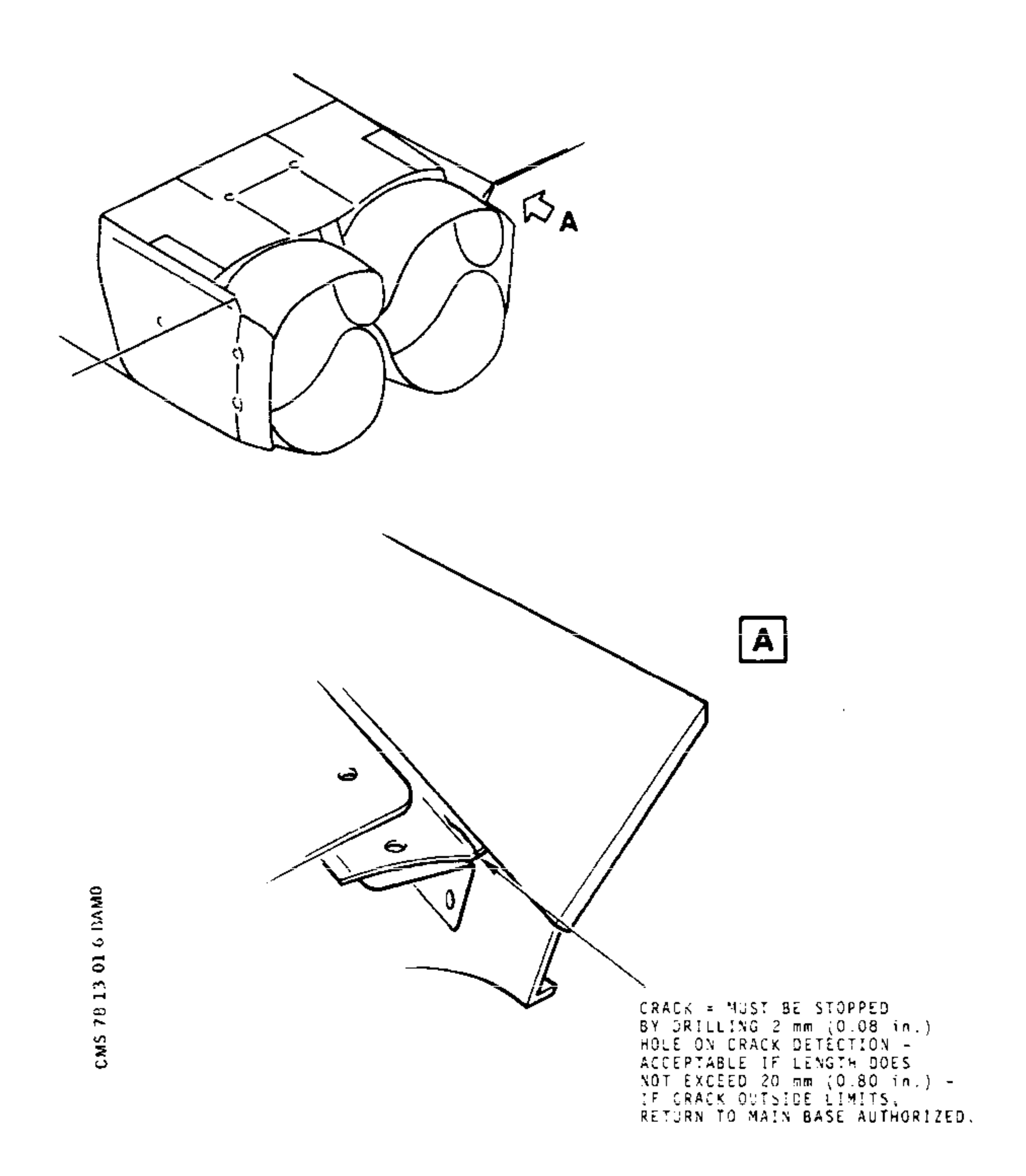
A. Examine the Twin Secondary Nozzle.

The purpose of this check is to provide evidence of core-to-face sheet separation or a deterioration of the internal



R
R
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Inspection of Twin Secondary Nozzle
- Acceptance Criteria
Figure 601



Inspection of Twin Secondary Nozzle
- Acceptance Criteria
Figure 602

R

LOOSENED RIVETS ACCEPTABLE PROVIDING THAT THE NUMBER OF CONSECUTIVE LOOSENED RIVETS DOES NOT EXCEED THREE RIVETS MAX. UNACCEPTABLE IF AT LEAST ONE RIVET IS ONE OF THE THREE SITUATED ON THE RIVET LINE END.

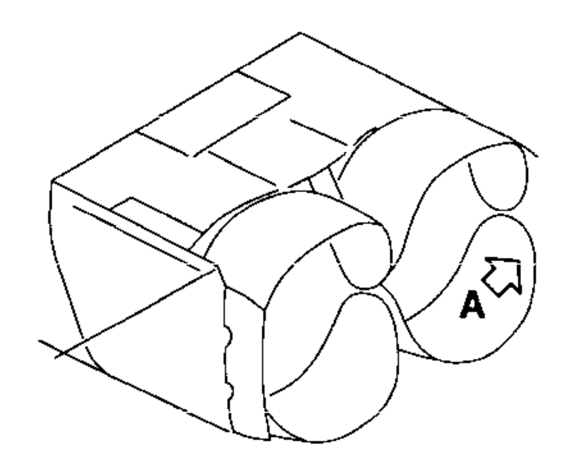
A

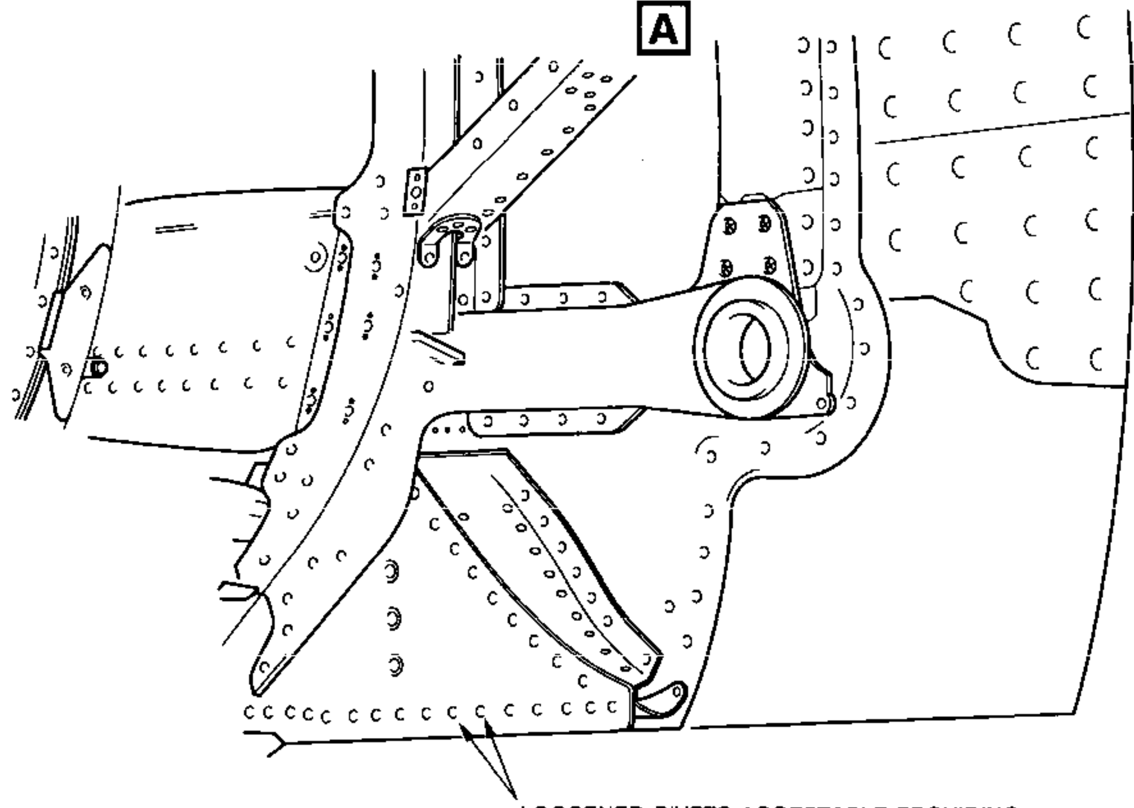
TAB CRACK OR FAILURE UNACCEPTABLE. RETURN TO MAIN BASE AUTHORIZED.

CMS 78 13 01 6 CAM0

Inspection of Twin Secondary Nozzle Lateral
Panel on Inner Side - Acceptance Criteria
Figure 603

R





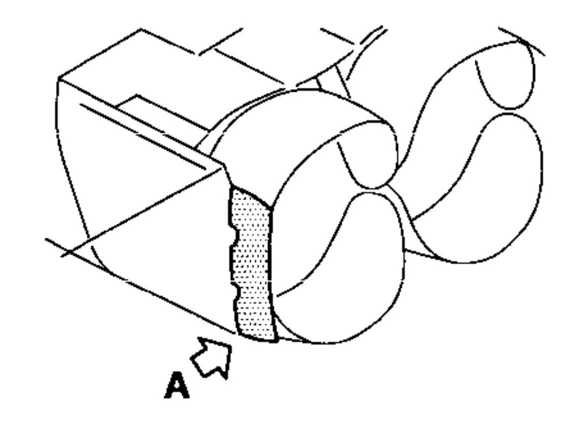
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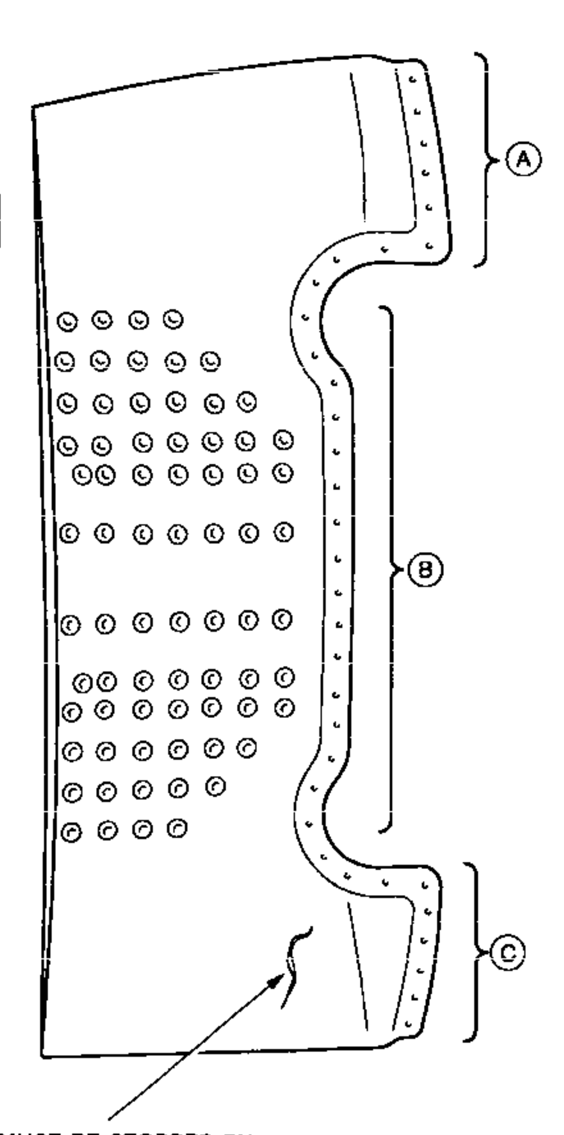
Inspection of Twin Secondary Nozzle Lateral
Panel on Inner Side - Acceptance Criteria
Figure 604

R

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LOOSENING OF UPPER DOUBLER RIVETS UNACCEPTABLE IF AFFECTING MORE THAN 30 PER CENT OF ALL RIVETS ON EACH DOUBLER COMPONENT.



(A) BROKEN SCREWS IN THIS AREA UNACCEPTABLE. RETURN TO MAIN BASE AUTHORIZED.

(B) FAILURE OF ATTACHMENT SCREWS UNACCEPTABLE IF AFFECTING MORE THAN 25 PER CENT OF ALL SCREWS LOCATED IN THIS AREA. RETURN TO MAIN BASE AUTHORIZED.

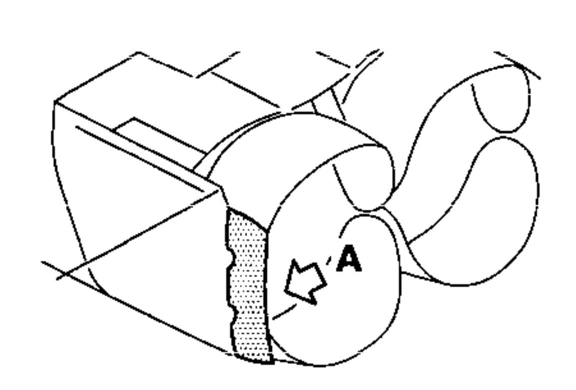
(C) BROKEN SCREWS IN THIS AREA UNACCEPTABLE. RETURN TO MAIN BASE AUTHORIZED.

CRACK - MUST BE STOPPED BY DRILLING 2 mm (0.08 in) HOLE ON CRACK DETECTION - ACCEPTABLE IF LENGTH DOES NOT EXCEED 50 mm (1.97 in) - IF CRACK OUTSIDE LIMITS, RETURN TO MAIN BASE AUTHORIZED.

CMS 78 13 01 6 EAMD 00

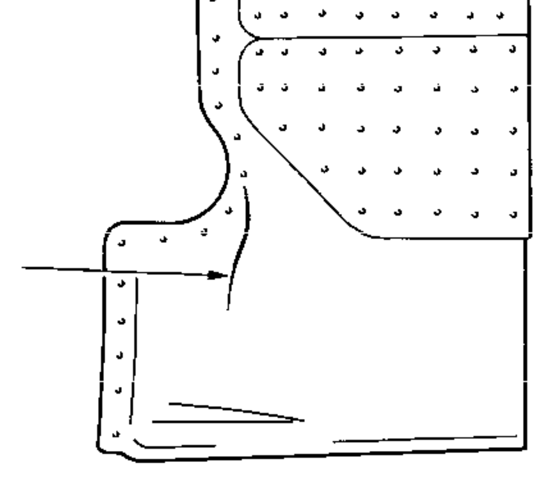
R

Inspection of Twin Secondary Nozzle Rear Lateral Panel on Outer Side - Acceptance Criteria
Figure 605



A

CRACKS - MUST BE STOPPED BY DRILLING 2 mm (0.08 in) HOLE ON CRACK DETECTION - ACCEPTABLE IF LENGTH DOES NOT EXCEED 50 mm (1.97 in) - IF CRACKS OUTSIDE LIMITS, RETURN TO MAIN BASE AUTHORIZED.



CRACKS - MUST BE STOPPED BY DRILLING 2 mm (0.08 in) HOLE ON CRACK DETECTION - ACCEPTABLE IF LENGTH DOES NOT EXCEED 50 mm (1.97 in) - IF CRACKS OUTSIDE LIMITS, RETURN TO MAIN BASE AUTHORIZED.

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CMS 78 13 01 6 FAND 00

R Inspection of Twin Secondary Nozzle Rear Lateral Panel on Inner Side - Acceptance Criteria
Figure 606

ADMISSIBLE MARKS OF WEAR

ADMISSIBLE DISTORTION OF OUTERMOST SEAL ELEMENTS

CRACKED OR MISSING UPPER OR LOWER SEAL ELEMENTS. ACCEPTABLE PROVIDED THE SUM TOTAL OF THE LENGTHS OF DAMAGED SEAL ELEMENTS DOES NOT EXCEED 50 OF THE OVERALL SEAL LENGTH.

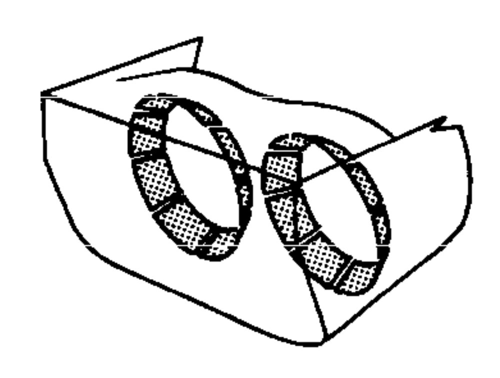
ACCEPTABLE CRACKS

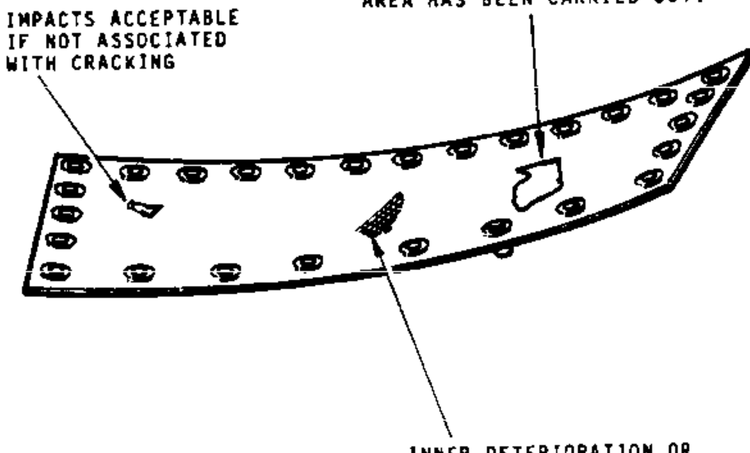
ACCEPTABLE CRACKS.

CMS 78 13 01 6 FUM0

Inspection of Twin Secondary Nozzle Heat Shield/Bucket Seal
Figure 607

R

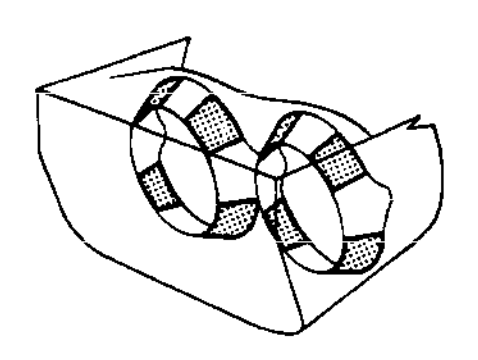


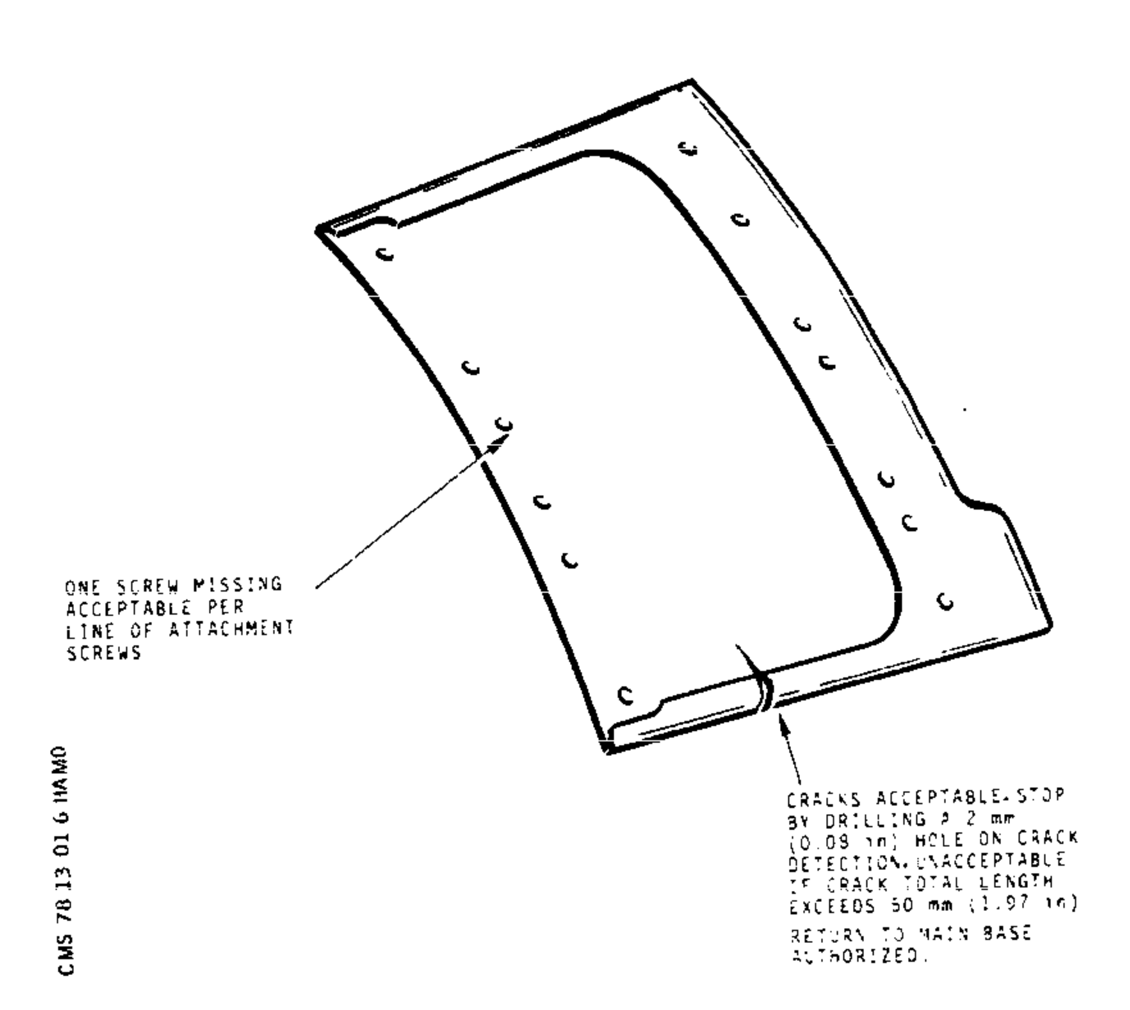


CMS 78 13 01 6 GAM0

Inspection of Twin Secondary Nozzle
Convergent Nozzle Panel - Acceptance Criteria
Figure 608

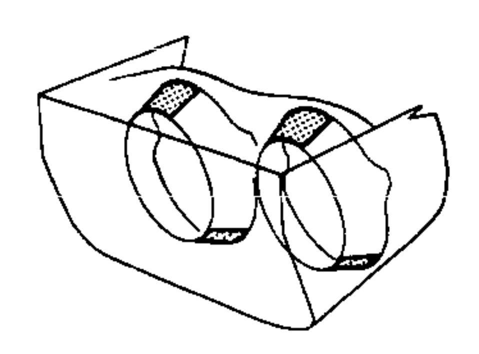
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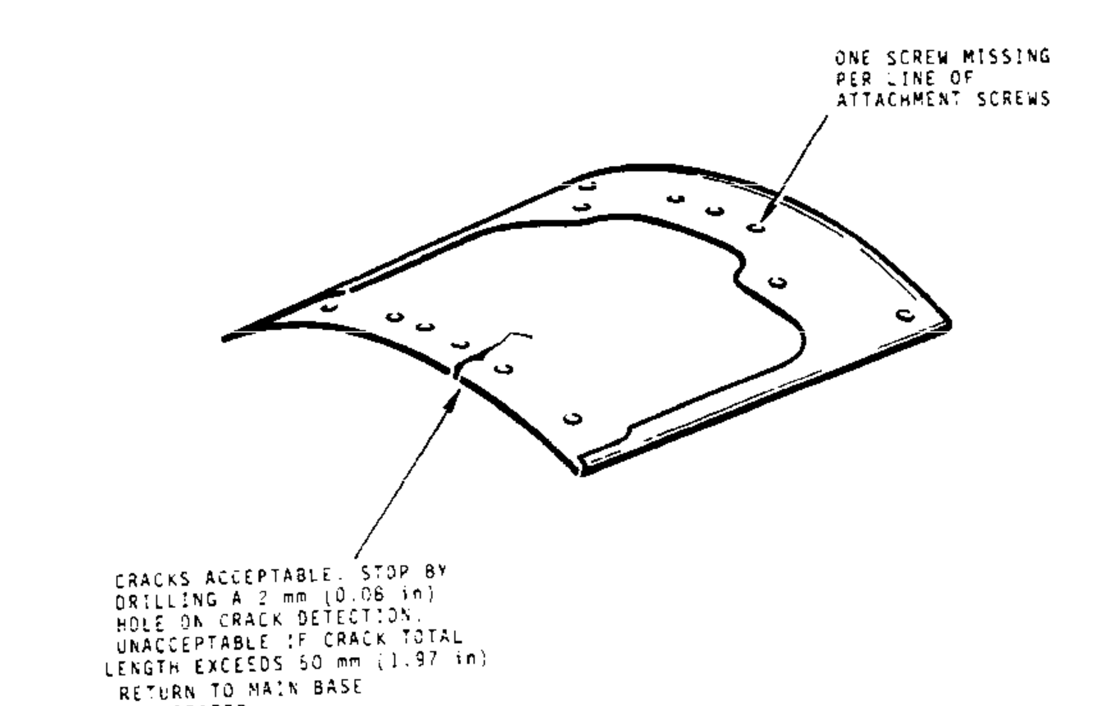




Inspection of Twin Seocondary Nozzle 45 Degree
Position Divergent Panel - Acceptance Criteria
Figure 609

R





CMS 78 13 01 6 JAMO

Inspection of Twin Seconadry Nozzle Upper and
Lower Divergent Panel - Acceptance Criteria
Figure 610

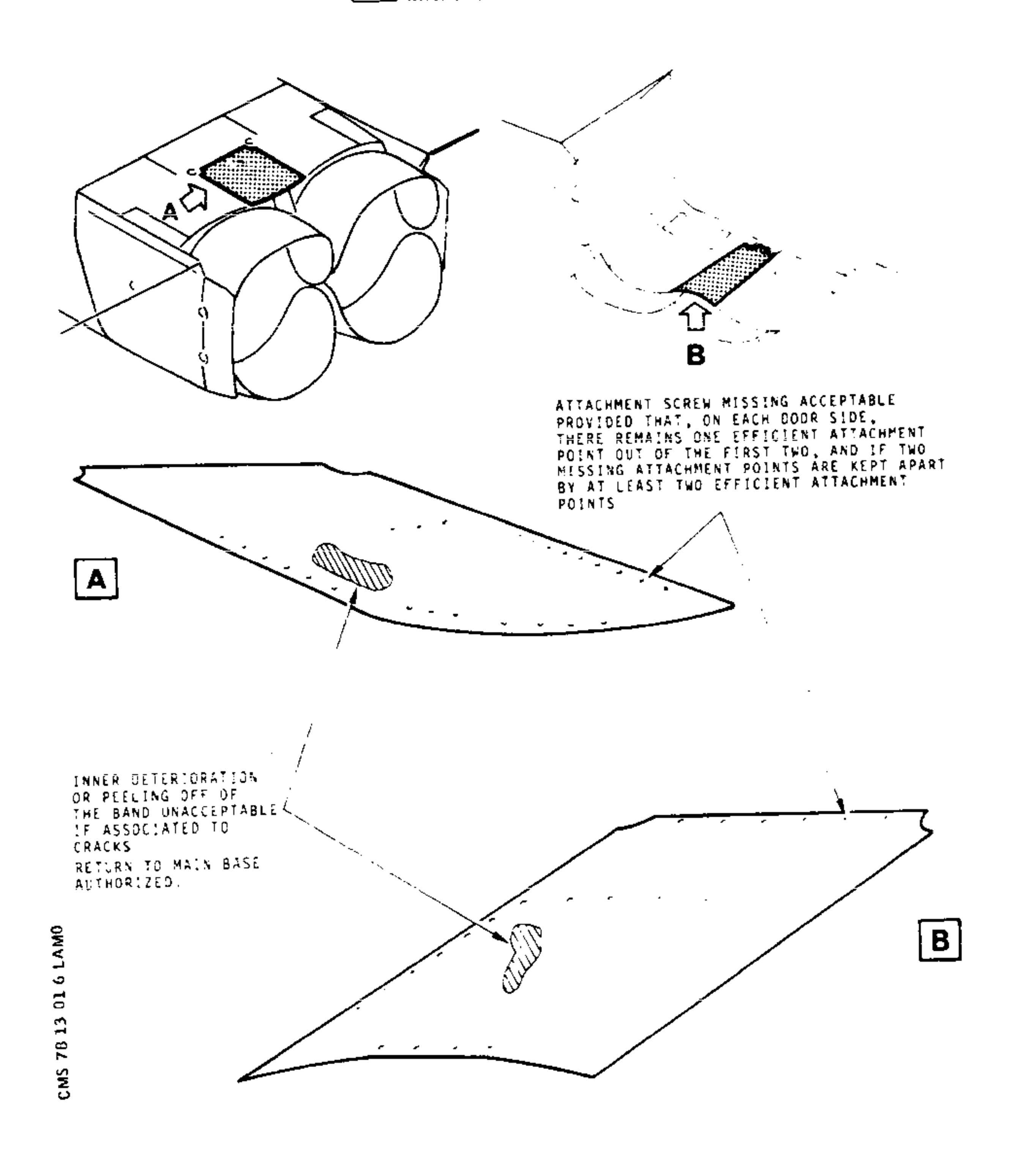
CRACKS ACCEPTABLE. STOP BY DRILLING A 2 mm (0.08 in.) HOLE ON CRACK DETECTION. UNACCEPTABLE IF CRACK TOTAL LENGTH EXCEEDS 50 mm (1.97 in.)
RETURN TO MAIN BASE AUTHORIZED.

ONE SCREW MISSING ACCEPTABLE PER LINE OF ATTACHMENT SCREWS

CMS 78 13 01 6 KAMO

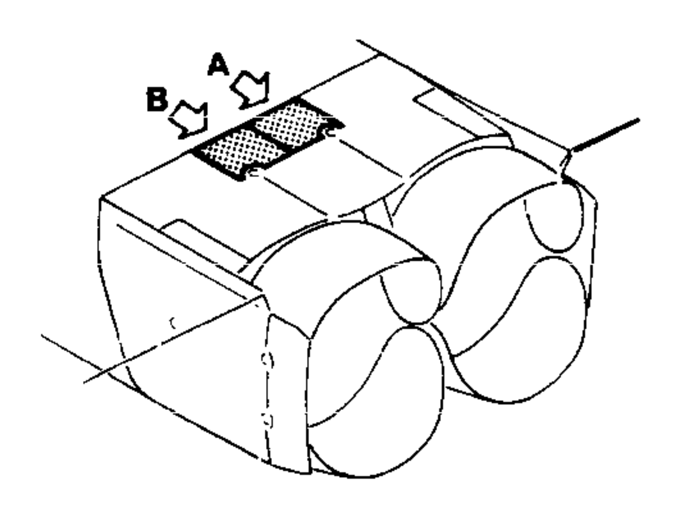
Inspection of Twin Secondary Nozzle Lateral Divergent Panel - Acceptance Criteria
Figure 611

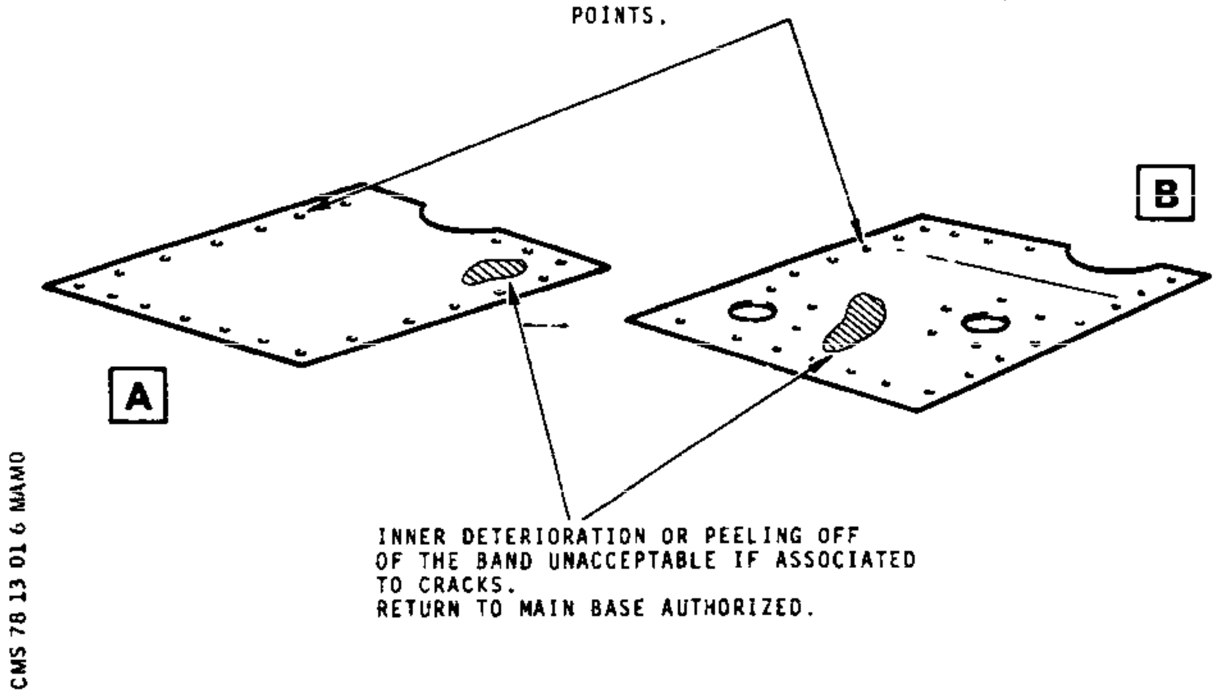
R



Inspection of Twin Secondary Nozzle Upper and Lower Central Access Door - Acceptance Criteria
Figure 612

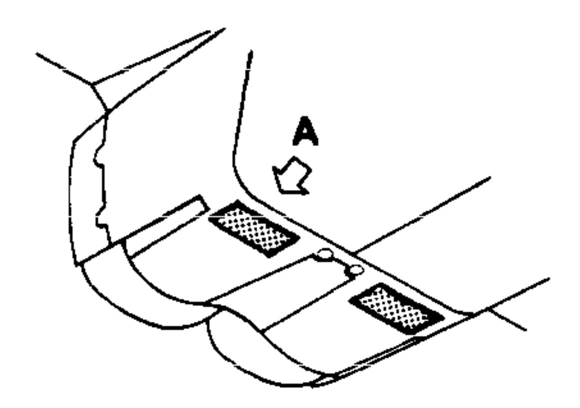
R

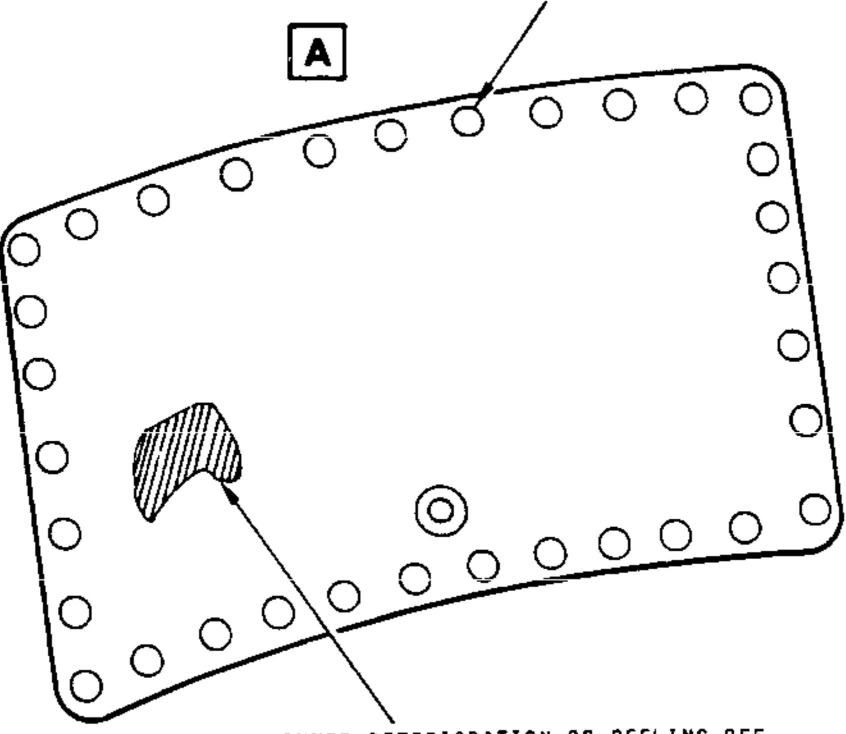




Inspection of Twin Secondary Nozzle Bucket
Pneumatic Drive Actuator Access Door - Acceptance Criteria
Figure 613

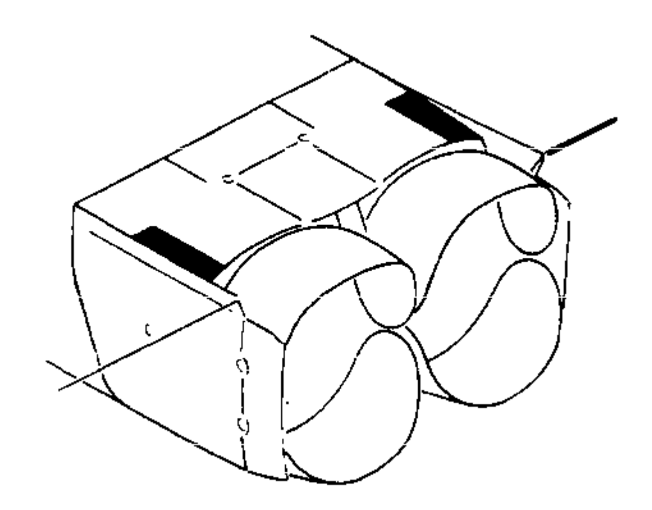
R

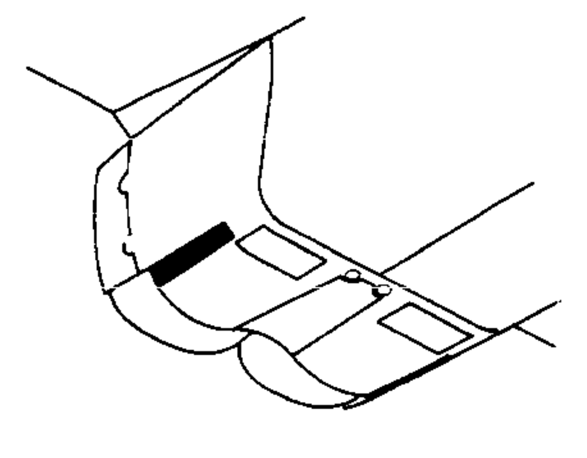


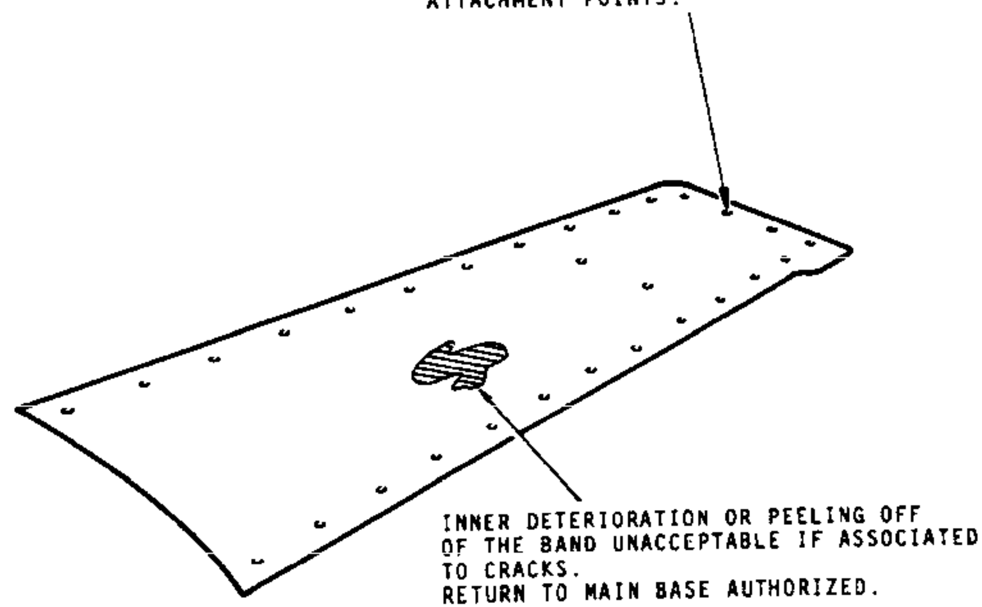


CMS 78 13 01 6 NAMO

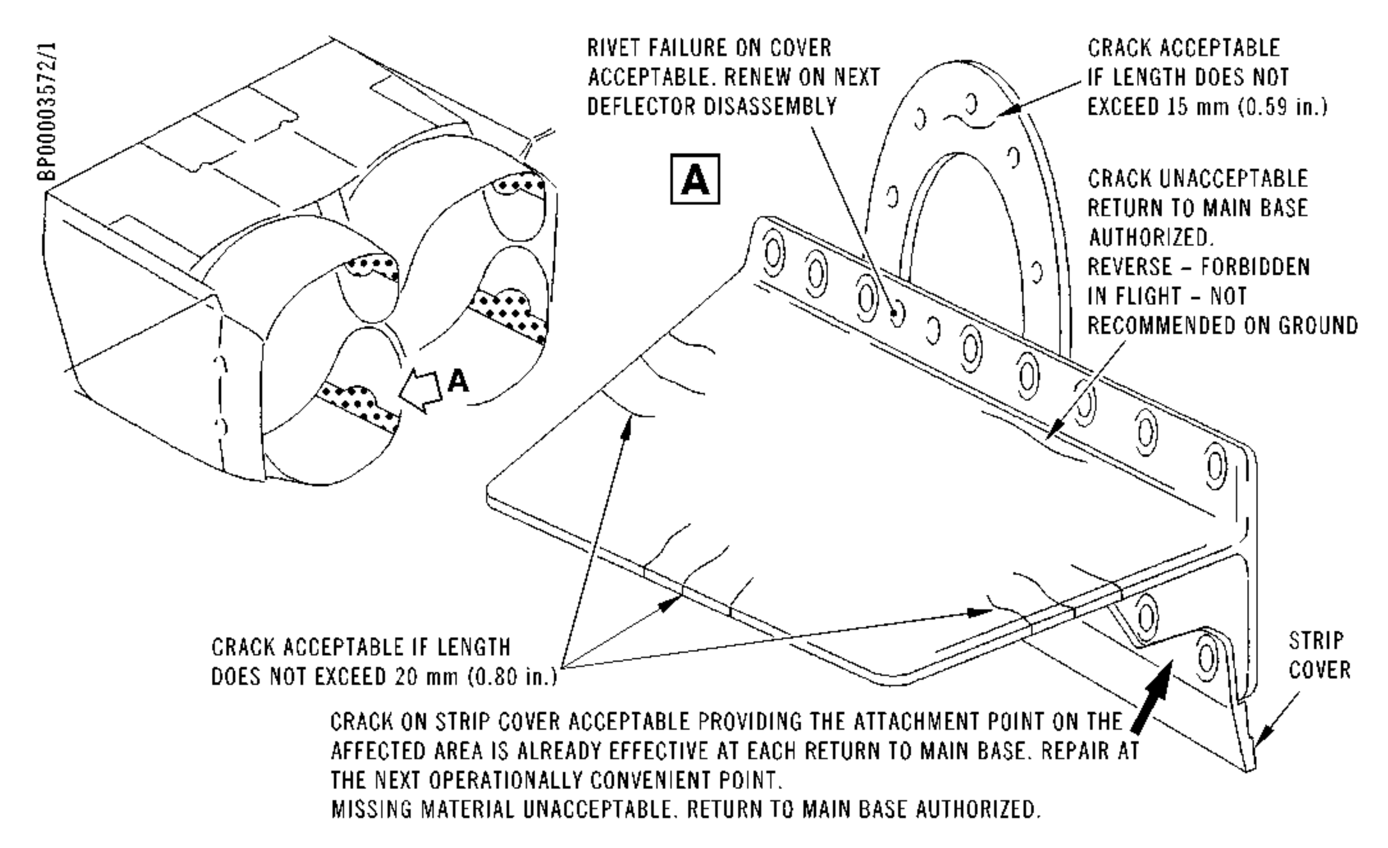
Inspection of Twin Secondary Nozzle Bucket
Position Transmitter Access Door - Acceptance Criteria
R Figure 614







Inspection of Twin Secondary Nozzle Bucket
Ballscrew Gearbox Upper and Lower Access Door Acceptance Criteria
R Figure 615



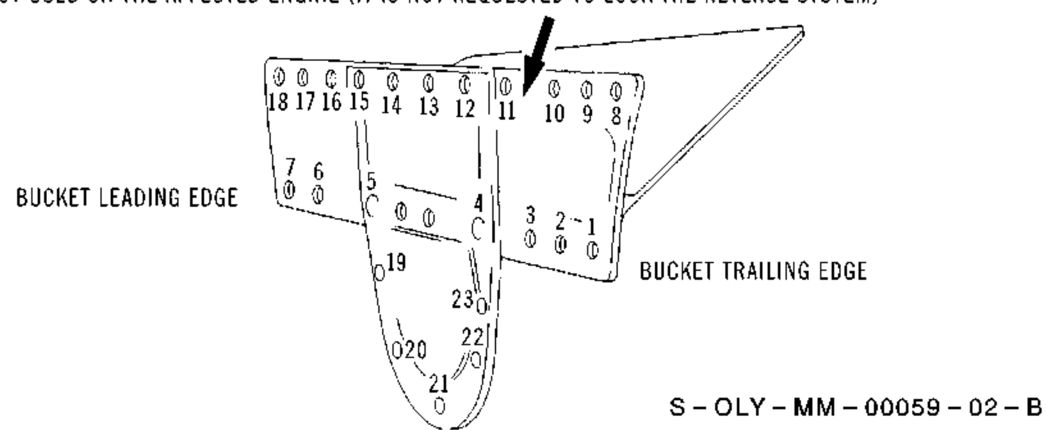
MISSING/BROKEN SCREWS OR UNCRIMPING BLIND NUTS ON BUCKET STRUCTURE ARE ACCEPTABLE PROVIDING A VISUAL INSPECTION AT EACH RETURN TO MAIN BASE AND:

A – ONE (1) AFFECTED ATTACHMENT IS REPAIRED AT THE NEXT 'INTERCHECK' OR OTHER OPERATIONALLY CONVENIENT POINT.

B – TWO (2) NON ADJACENT AFFECTED ATTACHMENTS (FOR EXAMPLE : POSITIONS 9 AND 11) ARE REPAIRED AT NEXT CHECK 'S' OR CHECK 'A'.

C – TWO (2) ADJACENT AFFECTED ATTACHMENTS (FOR EXAMPLE : POSITIONS 9 AND 10) OR THREE (3) AFFECTED ATTACHMENTS ARE UNACCEPTABLE. RETURN TO MAIN BASE AUTHORIZED, PROVIDED REVERSE IS NOT USED ON THE AFFECTED ENGINE (IT IS NOT REQUESTED TO LOCK THE REVERSE SYSTEM)

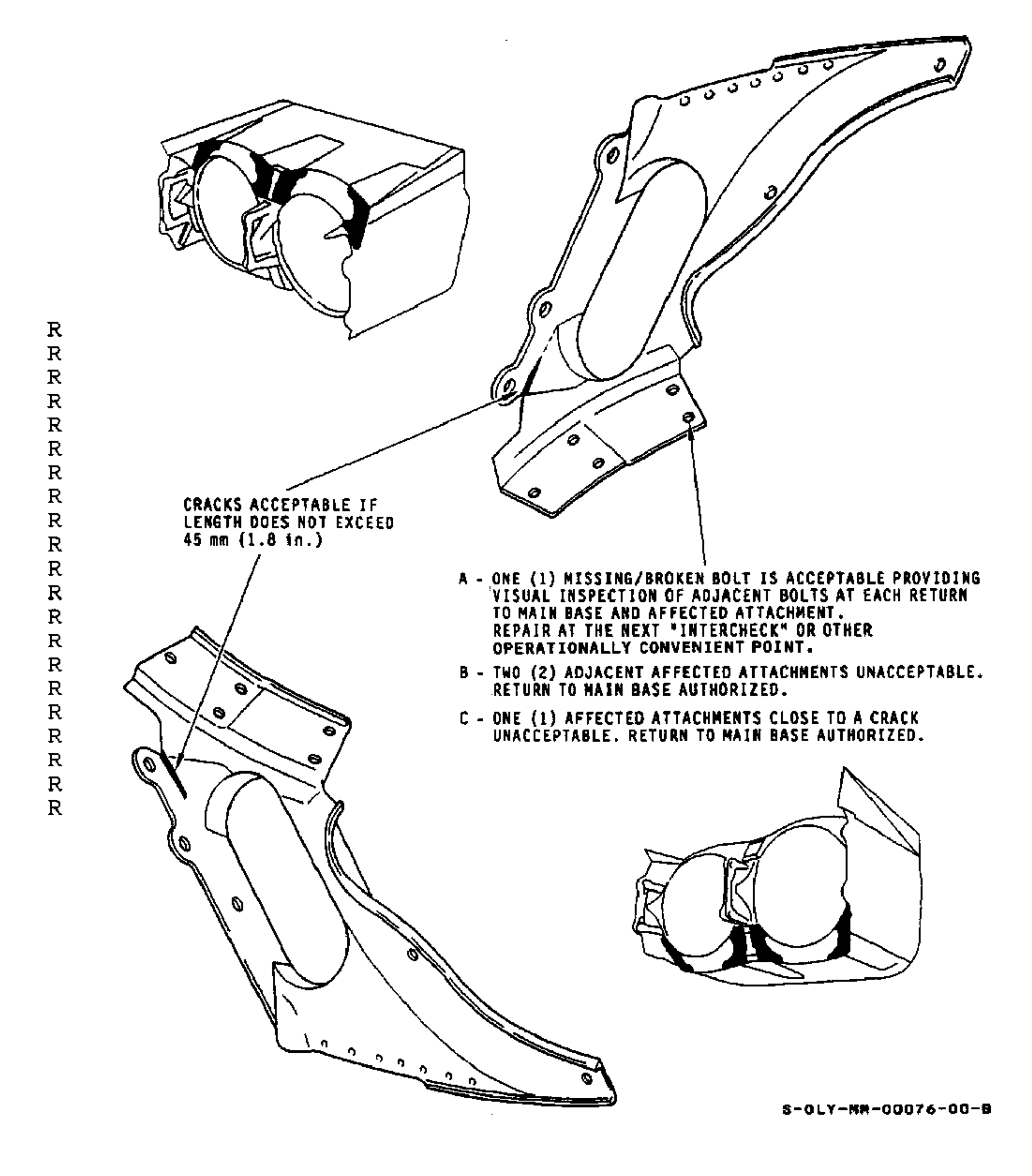
R
R



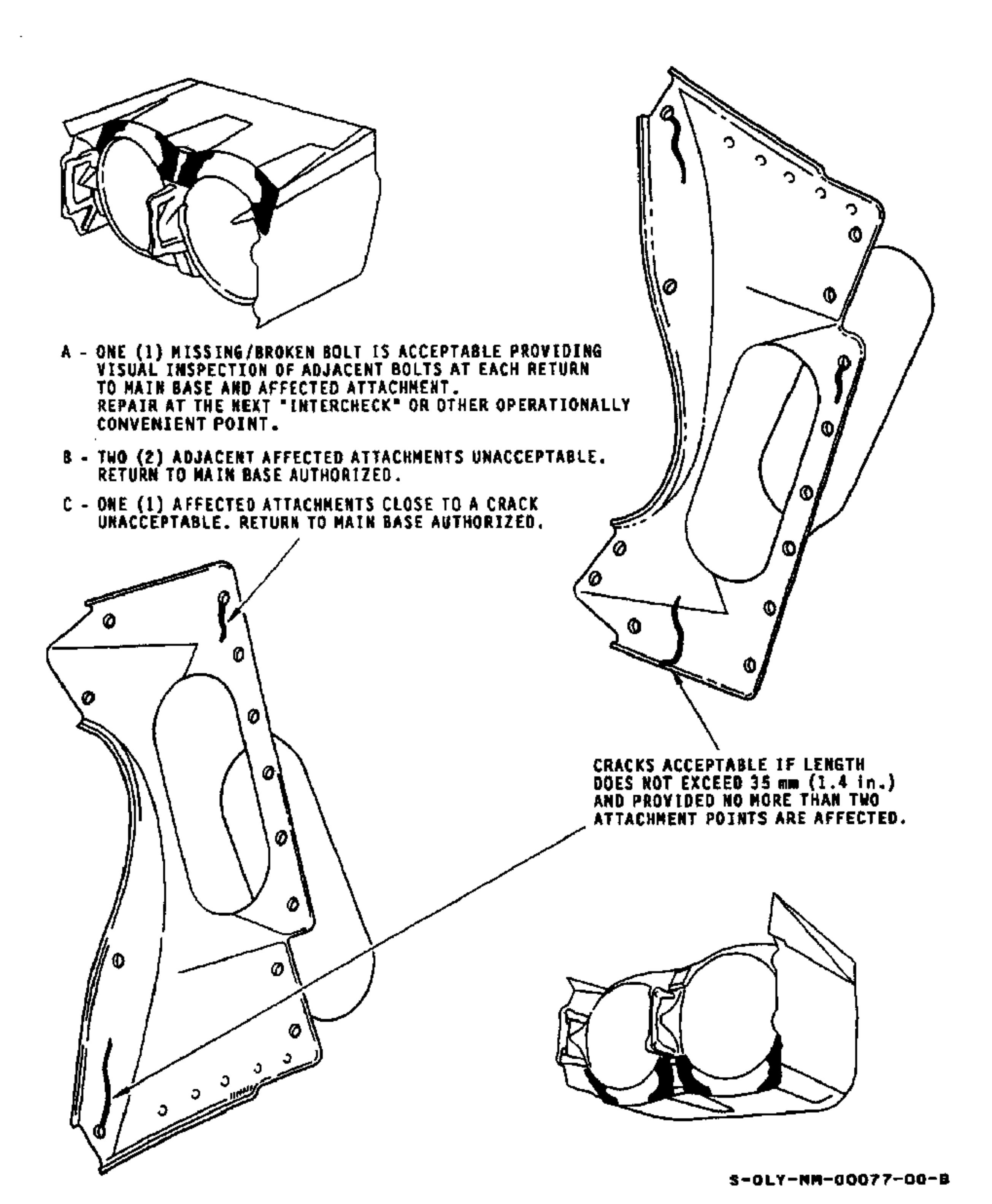
S – OLY – MM – 00059 – 02 – B

Inspection of Twin Secondary Nozzle Deflector - Acceptance Criteria
Figure 616

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Twin Secondary Nozzle Bucket Ballscrew
Gearbox Blanking Covers - Acceptance Criteria
Figure 617



Twin Secondary Nozzle Bucket Ballscrew
Gearbox Blanking Covers - Acceptance Criteria
Figure 618

ribbon.

This check is carried out by tapping lightly on the honeycomb panels using a small piece of metal such as a coin and is to be applied to all the honeycomb panels constituting the secondary nozzle by coin-tapping evenly every 3 or 4 cells.

A panel in good condition emits a clear sound whereas a panel with a deteriorated ribbon emits a dull sound.

NOTE: This checking method is less efficient in the areas where the stress skin panel contacts a fitting or a structural element and also in the crushed edge areas of panels.

B. Acceptance Criteria

Core-to-face sheet separation or deterioration of the internal ribbon is unacceptable. Repairs must be carried out as soon as the defect appears. Return to main base authorized.

5. Inspection of the Twin Secondary Nozzle Rear Side Walls-Aural Check of the Inner Face (Ref. Fig. 619)

NOTE: Inspection of the Twin Secondary Nozzle Rear Side walls inner face requires the removal of the upper and lower buckets.

A. Removal of the Buckets

(1) Remove upper and lower buckets. Refer to 78-31-01 page block 401.

B. Removal of the Rear Side Walls Heat Shields.

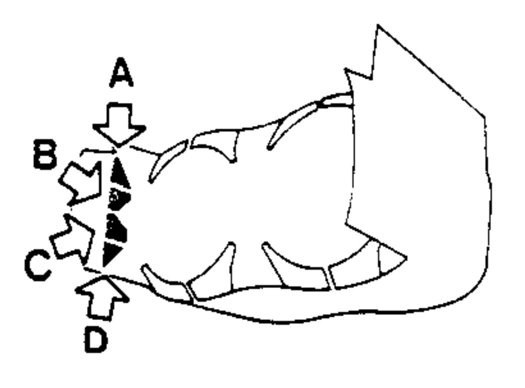
NOTE: Note the location of the different heat shields to be removed from the rear side walls. Also note the position of the various bolts and screws securing the heat shields.

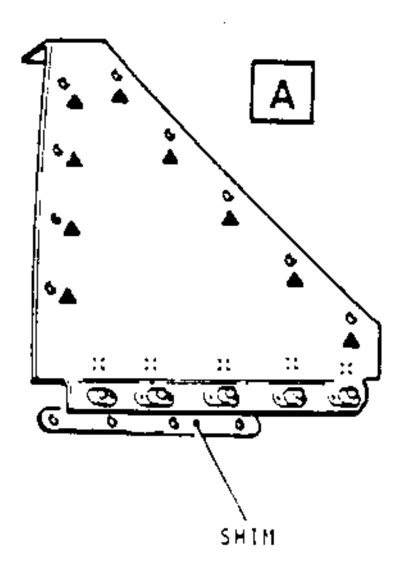
(1) Removing the Heat Shield A

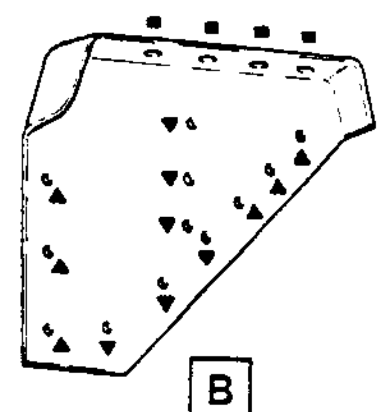
(a) Remove hexagonal head bolts and save plain washers.

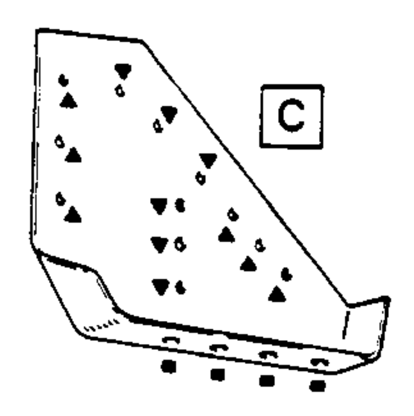
(b) Remove countersunk head screws and shim.

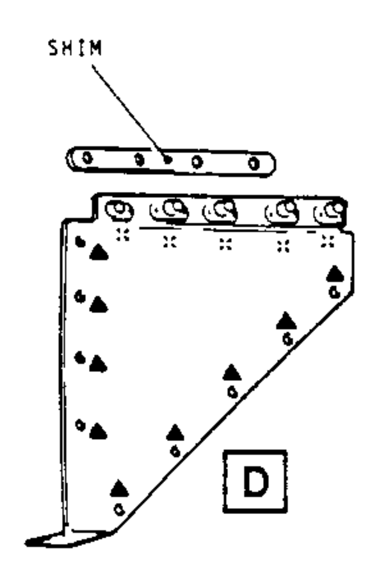
(c) Remove the heat shield.

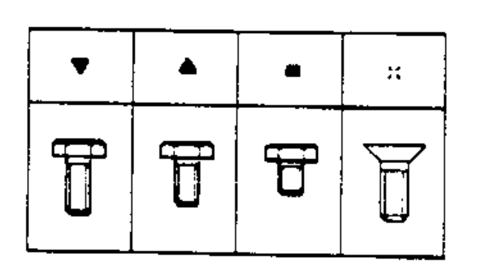












R Twin Secondary Nozzle - Inspection of Rear Side Walls
R Figure 619 (Sheet 1 of 2)

R
R

(2) Removing the Heat Shield B

(a) Remove hexagonal head bolts and save plain washers.

(b) Remove the heat shield.

(3) Removing the Heat Shield C

(a) Remove hexagonal head bolts and save plain washers.

(b) Remove the heat shield.

(4) Removing the Heat Shield D

(a) Remove hexagonal head bolts and save plain washers.

(b) Remove countersunk head screws and shim.

(c) Remove the heat shield.

(5) Removing the Heat Shield E

(a) Remove hexagonal head bolts and save plain washers.

(b) Remove countersunk head screws and shim.

(c) Remove the heat shield.

(6) Removing the Heat Shield F

(a) Remove hexagonal head bolts and save plain washers.

(b) Remove the heat shield.

(7) Removing the Heat Shield G

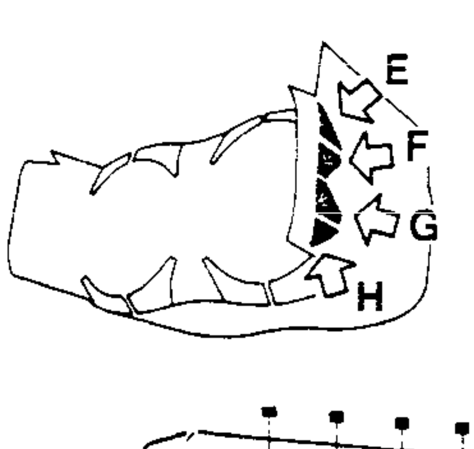
(a) Remove hexagonal head bolts and save plain washers.

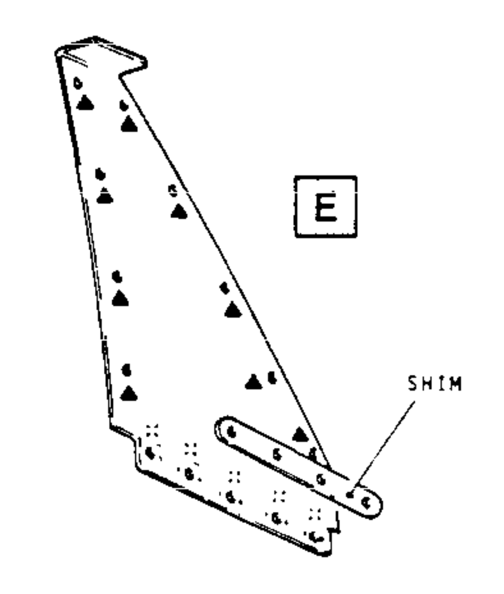
(b) Remove the heat shield.

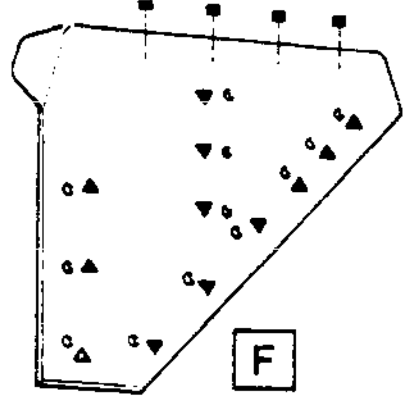
(8) Removing the Heat Shield H

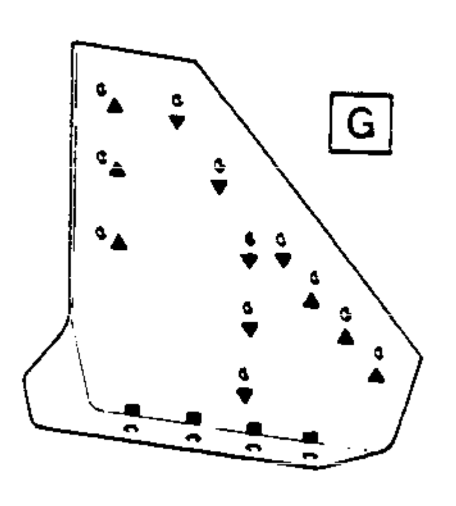
PRINTED IN FRANCE

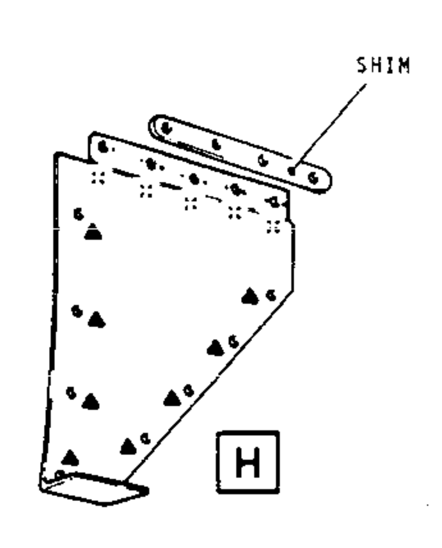
PRINTED IN ENGLAND

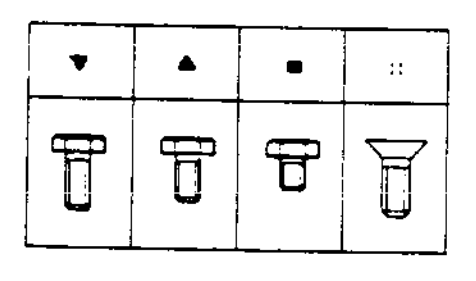












R Twin Secondary Nozzle - Inspection of Rear Side Walls
R Figure 619 (Sheet 2 of 2)

Printed in England

(a) Remove hexagonal head bolts and save plain washers.

(b) Remove countersunk screws and shim.

(c) Remove the Heat shield.

C. Inspection of the Rear Side Walls Inner Face.

(1) Check the rear side walls inner face by tapping lightly on the honeycomb panels, using a small piece of metal such as a coin. Using the coin, tap evenly every 3 or 4 cells.

A panel in good condition emits a clear sound, whereas a panel with a deteriorated ribbon emits a dull sound, evidencing either a core to face sheet separation or deterioration of the internal ribbon.

NOTE: This checking method is less efficient in the areas where the stresskin panel contacts a fitting or a structural element.

(2) Acceptance criteria

(a) Core-to-face sheet separation or deterioration of the internal ribbon is unacceptable. Repairs must be carried out as soon as the defect appears.

D. Installation of the Rear Side Walls Heat Shields.

(1) Installing the Heat Shield A

(a) Position the heat shield on the side wall, insert the shim and fix the countersunk head screws.

(b) Install the hexagonal head bolts, together with plain washers.

(c) Make sure that the head shield is firmly seated and will not damage the brackets.

(d) Torque-tighten the screws and hexagonal head bolts between 0,29 and 0,34 daN.m (2.12 to 2.54 lbf.ft).

(2) Installing the Heat Shield B.

(a) Position the heat shield on the rear side wall.

(b) Install the hexagonal head bolts, together with plain washers.

NOTE: Take care to position the bolts correctly in relation with their length.

(c) Make sure that the heat shield is firmly seated and will not damage the brackets.

(d) Torque-tighten the hexagonal head bolts between 0,29 and 0,34 daN.m (2.12 to 2.54 lbf.ft).

(3) Installing the Heat Shield C

(a) Position the heat shield on the rear side wall.

(b) Install the hexagonal head bolts, together with plain washers.

NOTE: Take care to position the bolts correctly in relation with their length.

(c) Make sure that the heat shield is firmly seated and will not damage the brackets.

(d) Torque-tighten the hexagonal head bolts between 0,29 and 0,34 daN.m (2.12 to 2.54 lbf.ft).

(4) Installing the Heat Shield D

(a) Position the heat shield on the rear side wall, insert the shim and fix the countersunk head screws.

(b) Install the hexagonal head bolts, together with plain washers.

(c) Make sure that the heat shield is firmly seated and will not damage the brackets.

(d) Torque-tighten the screws and hexagonal head bolts between 0,29 and 0,34 daN.m (2.12 to 2.54 lbf.ft).

(5) Installing the Heat Shield E

(a) Position the heat shield on the rear side wall, insert the shim and fix the countersunk head screws.

(b) Install the hexagonal head bolts, together with

plain washers.

(c) Make sure that the heat shield is firmly seated and will not damage the brackets.

(d) Torque-tighten the screws and hexagonal head bolts between 0,29 and 0,34 daN.m (2.12 to 2.54 lbf.ft).

(6) Installing the Heat Shield F

(a) Position the heat shield on the rear side wall.

(b) Install the hexagonal head bolts, together with plain washers.

NOTE: Take care to position the bolts correctly in relation with their length.

(c) Make sure that the heat shield is firmly seated and will not damage the brackets.

(d) Torque-tighten the screws and hexagonal head bolts between 0,29 and 0,34 daN.m (2.12 to 2.54 lbf/ft).

(7) Installing the Heat Shield G

(a) Position the heat shield on the rear side wall.

(b) Install the hexagonal head bolts, together with plain washers.

NOTE: Take care to position the bolts correctly in relation with their length.

(c) Make sure that the heat shield is firmly seated and will not damage the brackets.

(d) Torque-tighten the hexagonal head bolts between 0,29 and 0,34 daN.m (2.12 to 2.54 lbf.ft).

(8) Installing the Heat Shield H

(a) Position the heat shield on the rear side wall, insert the shim and fix the countersunk head screws.

(b) Install the hexagonal head bolts, together with plain washers.

(c) Make sure that the heat shield is firmly seated and will not damage the brackets.

(d) Torque-tighten the screws and hexagonal head bolts between 0.29 and 0.34 daN.m (2.12 and 2.54 lbf.ft).

E. Installation of the Buckets

(1) Reinstall the upper and lower buckets. Refer to 78-31-01, Page block 401.

6. Boroscopic Examination of the Twin Secondary Nozzle
(Ref. Fig. 620, 621 and 622)
R (Ref. Fig. 623, 624 and 625)

A. Equipment and Materials

DESCRIPTION	PART NO.
Rigid boroscope with the following characteristics : - Dia. : 11 mm (0.43 in.) Length : 600 mm (23.62 in.) and 800 mm (31.50 in.) - Dia. : 19 mm (0.75 in.) Length : 1500 mm (59.05 in.)	-
Flexible boroscope 11 mm (0.43 in.) dia. and 100 mm (39.37 in.) in length.	-
Appropriate electrical supply	-

B. Prepare the Twin Secondary Nozzle for Boroscope Inspection.

(1) Open engine bay rear lower doors (Ref. 71-00-00 Servicing).

(2) Remove door or cover giving access to the area to be examined (Ref. Figs. 618 to 623 and Table 602).

NOTE: Access to some covers or doors is only possible when the secondary nozzle is removed from the aircraft.

C. Inspect the Twin Secondary Nozzle

(1) Introduce the boroscope in the appropriate access holes.

(2) Inspect panel surfaces for cleanliness, damage, corrosion and delamination.

(3) Inspect the different panels for security of attachment.

(4) Inspect secondary nozzle mount fittings (upper, lower, side fittings).

(5) Inspect secondary nozzle longerons for cracks or deformations.

D. Conclusion

(1) Remove the boroscope

(2) Install the access panels and torque tighten the bolts and screws to the values given in Table 602.

(3) Close the engine bay rear lower doors (Ref. 71-00-00 Servicing)

ZONE	PANEL/DOOR IDENT.	TYPE OF FASTENER	TORQUE LOAD daN.m	lbf.ft	DESCRIPTION
417	417-BL	Screw	0.8 to 0.9	5.90 to 6.64	DOOR
	417-CL				DOOR
	417-DL				COVER
	417-EL				COVER
	417-FL				COVER
	417-GL				COVER
	417-HL				COVER
	417-PZ				COVER
	417-QZ				COVER
	417-RZ				COVER
	417-SZ				COVER
	417-TZ				COVER
	417-VZ				COVER
418	418-UZ	Screw	0.8 to 0.9	5.90 to 6.64	COVER
	418-WZ				COVER
	418-XZ				COVER
427	427-UZ	Screw	0.8 to 0.9	5.90 to 6.64	COVER
	428-BR	Screw	0.8 to 0.9	5.90 to 6.64	DOOR

ZONE	PANEL/DOOR IDENT.	TYPE OF FASTENER	TORQUE LOAD daN.m lbf.ft	DESCRIPTION
	428-CR			DOOR
	428-DR			COVER
	428-ER			COVER
	428-FR			COVER
428	428-GR			COVER
	428-HR			COVER
	428-PZ			COVER
	428-QZ			COVER
	428-RZ			COVER
	428-SZ			COVER
	428-TZ			COVER
	428-VZ			COVER
	437=BL	Screw	0.8 to 0.9 5.90 to 6.64	DOOR
	437-CL			DOOR
	437-DL			COVER
	437-EL			COVER
	437-FL			COVER
437	437-GL			COVER
	437-HL			COVER
437	437-PZ	Screw	0.8 to 0.9 5.90 to 6.64	COVER
	437-QZ			COVER
	437-RZ			COVER
	437-SZ			COVER
	437-TZ			COVER
	437-VZ			COVER
	438-UZ	Screw	0.8 to. 0.9 5.90 to 6.64	COVER
438	438-WZ			COVER
	438-XZ			COVER
447	447-UZ	Screw	0.8 to 0.9 5.90 to 6.64	COVER
	448-BR	Screw	0.8 to 0.9 5.90 to 6.64	DOOR
	448-CR			DOOR
	448-DR			COVER
	448-ER			COVER
	448-FR			COVER
448	448-GR			COVER
	448-HR			COVER
	448-PZ			COVER
	448-QZ			COVER

ZONE	PANEL/DOOR IDENT.	TYPE OF FASTENER	TORQUE LOAD daN.m lbf.ft	DESCRIPTION
	448-RZ			COVER
	448-SZ			COVER
	448-TZ			COVER
	448-VZ			COVER

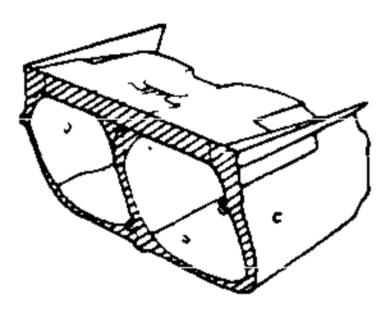
Twin Secondary Nozzle Endoscopic Examination-Access Doors and Covers Table 602

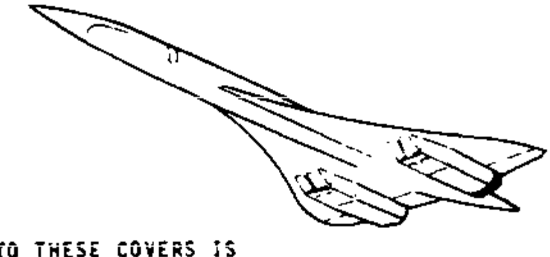
417 FL
417 CL
417 DL
417 VZ*
417 HL
417 GL
417 BL
417 EL

CMS 78 13 01 6 SAMO

* NOTE : ACCESS TO THESE COVERS IS ONLY POSSIBLE WHEN THE SECONDARY NOZZLE IS REMOVED FROM THE AIRCRAFT.

R Twin Secondary Nozzle - Boroscope Inspection
Figure 620





* NOTE : ACCESS TO THESE COVERS IS ONLY POSSIBLE WHEN THE SECONDARY NOZZLE IS REMOVED FROM THE AIRCRAFT

428 VZ*
417 VZ*
428 PZ
428 QZ
428 RZ
428 SZ
428 TZ
418 WZ
427 UZ
418 UZ
418 XZ
417 PZ
417 QZ
417 RZ
417 SZ
417 TZ

CMS 78 13 01 6 TAMO

Twin Secondary Nozzle - Boroscope Inspection
Figure 621

R

428 HR
428 OR
428 CR
428 FR
428 ER
428 BR
428 GR

CMS 78 13 01 6 UAMO

R

Twin Secondary Nozzle - Boroscope Inspection
Figure 622

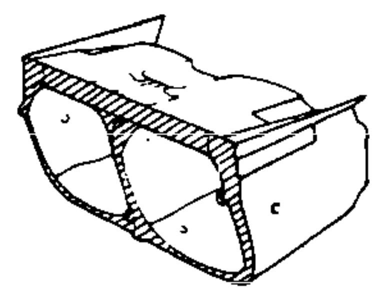
437 FL
437 CL
437 DL
437 VZ*
437 HL
437 GL
437 BL
437 EL

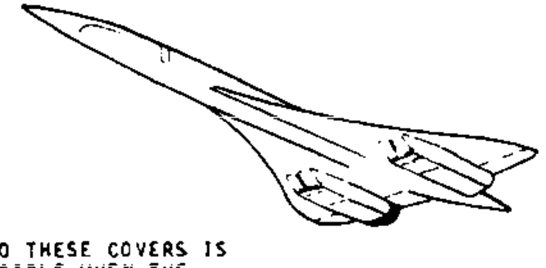
* NOTE : ACCESS TO THESE COVERS IS ONLY POSSIBLE WHEN THE SECONDARY NOZZLE IS REMOVED FROM THE AIRCRAFT.

CMS 78 13 01 6 VAMO

Twin Secondary Nozzle - Boroscope Inspection
Figure 623

R





× NOTE : ACCESS TO THESE COVERS IS ONLY POSSIBLE WHEN THE SECONDARY NOZZLE IS REMOVED FROM THE AIRCRAFT

448 VZ×
437 VZ×
448 PZ
448 QZ
448 RZ
448 SZ
448 TZ
438 WZ
447 UZ
438 UZ
438 XZ
437 PZ
437 QZ
437 RZ
437 SZ
437 TZ

CMS 78 13 01 6 WAMO

Twin Secondary Nozzle - Boroscope Inspection
Figure 624

R

448 DR
448 CR
448 FR
448 HR
448 ER
448 BR
448 GR

CMS 78 13 01 6 XAMO

Twin Secondary Nozzle - Boroscope Inspection
Figure 625

R

TWIN SECONDARY NOZZLE - APPROVED REPAIRS

1. General

This chapter defines the procedure to renew the seal on the bucket position transmitter (Indicator) access panel.
This operation should be performed every time the seal is found defective. Bearing in mind that this operation takes at least 24 hours, it will be possible to perform it only at the first opportunity compatible with the aircraft schedule.

2. Renewing the seal on the bucket position transmitter (Indicator) access panel

A. Equipment and Materials

DESCRIPTION	PRODUCT FILE CODE NO
- Rhodorsil CAF4 Thixo	P474
- Acetone	P325
- Primer MB	P475
- 4812A catalyst	P546
R - Sansil Luborflon	P541
- Spatula	-
- Lint free cloth	-
- Brushes	-
- Sharpened plexi-glass blade	-

B. Prepare to renew the seal.

(1) Remove the remaining parts of the defective seal using sharpened plexi-glass blade (Ref. Fig. 801).

NOTE: Damping the seal with white-spirit can help when removing the remaining parts of the seal.

(2) Clean the access panel, taking special care to clean with acetone areas A and B where the seal is going to be applied. These areas must be perfectly cleaned (Ref. Fig. 801).

(3) Clean perfectly the area C on the secondary nozzle (Ref. Fig. 801).

(4) Using a perfectly clean brush, put a coat of primer MB on the area where the seal is going to be applied, areas A and B (Ref. Fig. 801).

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CAUTION: AVOID PUTTING FINGERS ON THE AREA TREATED WITH THE PRIMER.

(5) Spray a coat of Sansil Luborflon on the area "C" of the secondary nozzle (Ref. Fig. 801). Make sure that the coat covering this surface is continuous.

CAUTION: THE "SANSIL LUBORFLON CAN" MUST BE WELL SHAKEN BEFORE USE.

(6) Apply a thin coat of oil on the screws used to fix the access panel to prevent sticking of the Phodorsil to the threads.

C. Preparation of the silicone rubber sealant.

(1) Weigh a 100 grams (3.527 oz) of rhodorsil CAF 4 THIXO and dispose it on a plate of metal.

(2) Weigh 4 grams (0.140 oz) of 4812 A catalyst and add it to the Rhodersil.

(3) Using a spatula, mix quickly and thoroughly the two products together.

D. Renewing the seal (Ref. Fig. 802)

(1) Using the spatula apply the silicone rubber on the area A all around the access panel.

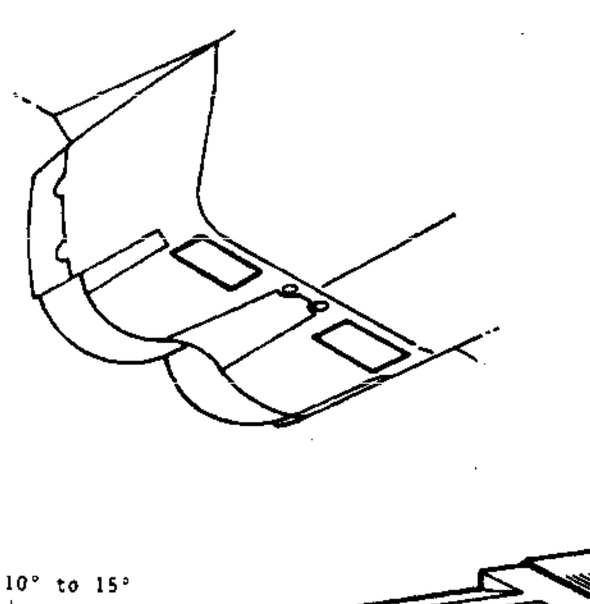
CAUTION: THIS OPERATION MUST BE PERFORMED AS QUICKLY AS POSSIBLE BEFORE POLYMERISATION OF THE SILICONE RUBBER STARTS.
ACCORDING TO THE AMBIENT TEMPERATURE, POLYMERISATION CAN BE VERY RAPID.

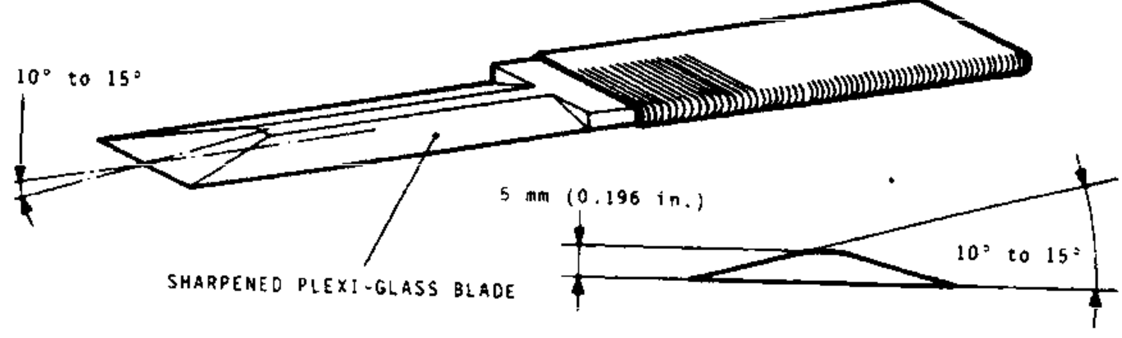
(2) Put two screws at two opposite corners of the access panel.

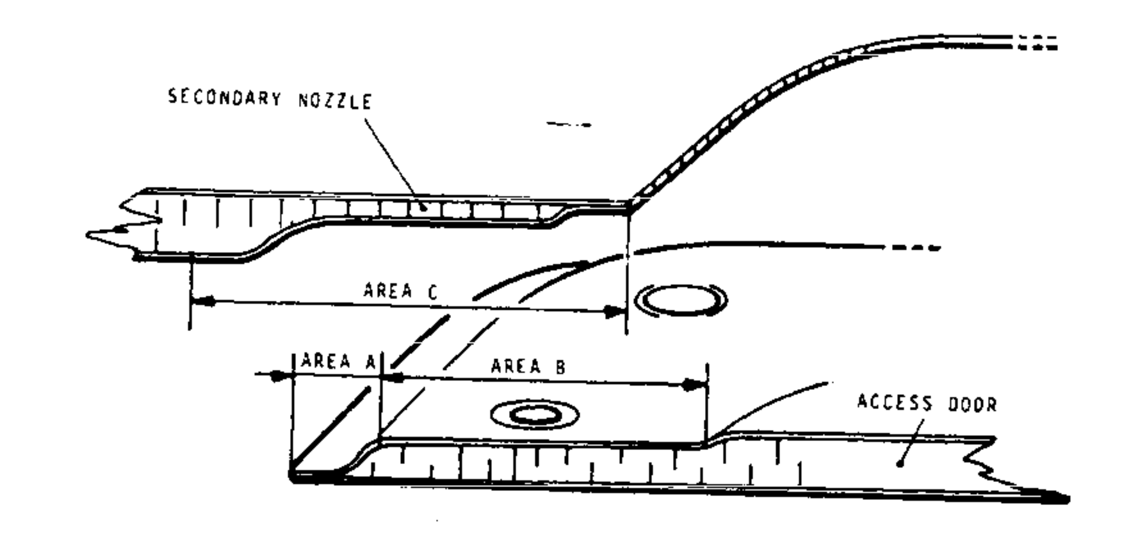
(3) Present the access panel on the secondary nozzle and hold it in this position using the two screws.

R (4) Install the remaining fitting screws on the access
R panel.

(5) Using a pneumatic vibration screwdriver pre-adjusted at 0.60 daN.m (53 lbf in.) torque tighten the fixing screws of the access panel.

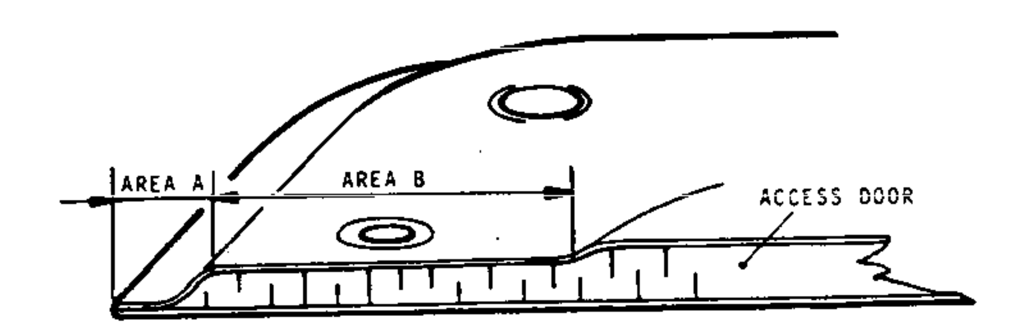


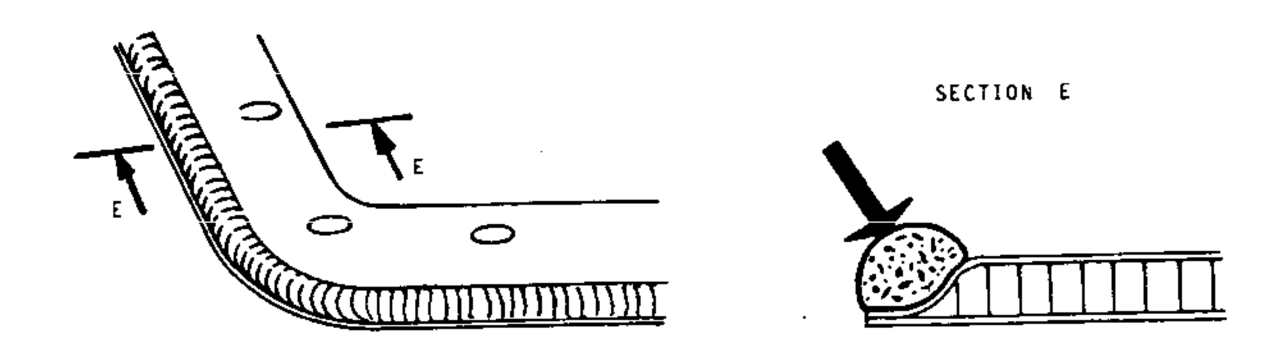


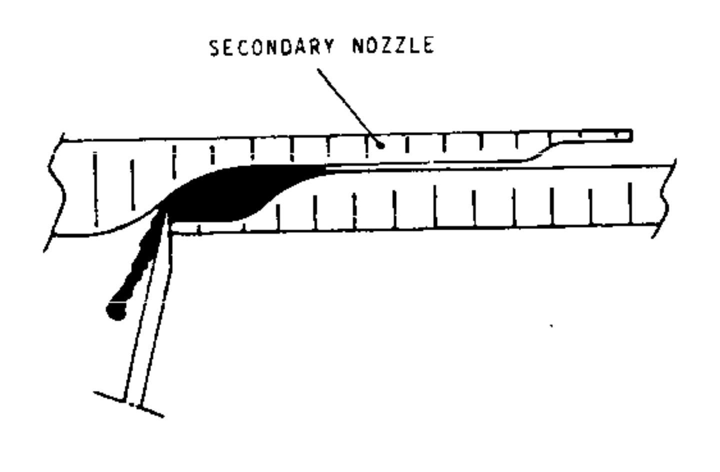


CMS 78 13 01 8 AAMO

R Prepare to Renew the Seal on the Bucket Position Transmitter (Indicator) Access Panel
Figure 801







CMS 78 13 01 8 BAMO

Renewing the Seal on the Bucket
Position Transmitter (Indicator) Access Panel
Figure 802

R

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREW-DRIVER HEAD.
USING MANUAL OR UNAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATIONS OF THE SCREWS.

(6) Dispose of the excess of silicone rubber by trimming it off using a sharpened plexi-glass blade.

(7) Leave the Silicone Rubber to polymerize for at least 24 hours.

(8) Using a pneumatic impact wrench remove the screws from the access panel.

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREW-DRIVER HEAD.
USING MANUAL OR UNAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATIONS OF THE SCREWS.

(9) Remove the access panel, if necessary use a sharpened light alloy blade to exert pressure between the access panel and the secondary nozzle.

(10) Clean the screws. Remove the Silicone rubber from the screw threads.

E. Partial refection of the Silicone Rubber Seal

NOTE: After removal of the door, some defects in the quality of the Silicone Rubber seal may appear. Generally they are due to a defective distribution of the Phodorsil on the door. It is possible to fill up this defects if they were to have an effect on the integrity of the seal.

(1) Clean the defective area with acetone, again make sure not to touch this area with fingers.

(2) Using a tube of Phodorsil fill up the defective area.

NOTE: Rhodorsil CAF 4 THIXO or ordinary Rhodorsil CAF 4 can be used concurrently 4812 A CATALYST is not used when repairing these defects.

(3) Use a spatula to smooth and dispose off the Rhodorsil in excess.

(4) Leave to polymerize for at least one hour.

ELECTRICAL WIRING (BAYS 1 AND 3) - REMOVAL/INSTALLATION

1. General

This chapter describes the procedure for Removal/Installation of the Electrical Wiring attached to the Engine Bays 1 or 3 of the Twin Secondary Nozzles.
This Electrical Wiring connects the Bucket Pneumatic Drive Actuator and the Bucket Position Transmitter (Indicator) to the Aircraft Wiring.

NOTE: For Removal/Installation of the Electrical Wiring attached to the Engine Bays 2 and 4 refer to 78-13-12 Page Block 401.

2. Removal/Installation of the Electrical Wiring (Ref. Fig. 401)

A. Equipment and Materials.

Description	Part No.
Pneumatic vibration screwdriver (preadjusted at 0.60 daN.m, 53 lbf.in.) and the appropriate screwdriver head.	
Pneumatic impact wrench (unscrewing mode) ARO 8530 Pc 1 and the appropriate screwdriver head.	
Torque wrench (0 to 3 daN.m, 0 to 265 lbf.in.) in range.	
Circuit Breaker Safety Clips,	
Plastic Sheath	PRODUCT FILE CODE No. P457

B. Prepare to Remove the Electrical Wiring.

(1) Electrically isolate the engine and exhaust assembly services indicated in Table 401 by tripping the circuit breaker affecting the engine in the nacelle upon which work is being carried out. Install circuit breaker safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINE No. 1			
WIND DOWN CONT SUP 1	5-213	1K1101	B 1
WIND DOWN CONT SUP 2	1-213	1K1108	C 7
BUCKET CONT UNIT SUP	14-215	1K1132	E 12
REV BUCKET POSN IND	5-213	1E121	A 3
REV THRUST CONT	3-213	1K331	D 1
REV THRUST ASOV CONT	3-213	1K334	G 3
ENGINE No. 3			
WIND DOWN CONT SUP 1	1-213	3K1101	F 5
WIND DOWN CONT SUP 2	5-213	3K1108	C 2
BUCKET CONT UNIT SUP	13-216	3K1132	C 6
REV BUCKET POSN IND	1-213	3E121	B 8
REV THRUST CONT	1-213	3K331	B 6
REV THRUST ASOV CONT	1-213	3K334	D 8

Circuit Breakers
Table 401

WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE ON WHICH REMOVAL IS CARRIED OUT.

(2) Display a suitable placard on the engine starting panel, indicating that personnel are working on the engine and Twin Secondary Nozzle area.

(3) Using a pneumatic impact wrench equipped with an appropriate screwdriver head, remove the respective access panels to the Bucket Pneumatic Drive Actuator, the upper lateral Bucket Ballscrew Gearbox, the upper central Bucket Ballscrew Gearbox, the lower lateral

Bucket Ballscrew Gearbox, the Bucket Position Transmitter (Indicator).

<u>CAUTION</u>: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.
USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS. BEFORE CARRYING OUT ANY WORK, THE SECONDARY NOZZLE MUST BE LINED WITH RUBBER CARPETS TO AVOID DAMAGE RESULTING FROM ACCIDENTIAL BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES MUST ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

C. Removal of the Electric Wiring.

(1) Unlock and disconnect the three Bucket Position Transmitter (Indicator) electrical connectors.

(2) Unscrew the self-locking nuts and bolts and remove the three clips securing the electrical wiring. (Ref. Fig. 401, Detail D).

(3) In the lower lateral Ballscrew Gearbox housing, unscrew self-locking nuts and bolts and remove the three clips securing the electrical wiring.(Ref.Fig.401, Detail C).

(4) Disengage the Teflon sheathed electrical wiring from the channel unit and remove the Teflon spiral. (Ref. Fig. 401, Details C and D).

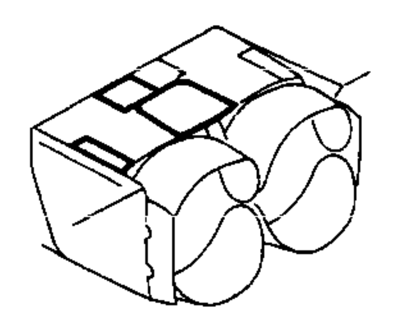
(5) On the Bucket Position Transmitter (Indicator) side of the harness, arrange the connectors so that they may be easily withdrawn through the harness guide tube. Retain them with a plastic sheath.

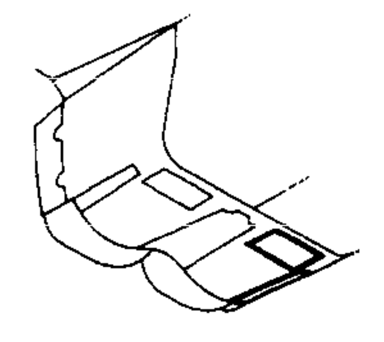
(6) In the upper lateral ballscrew gearbox housing, unscrew the bolt and remove the clip securing the electrical wiring. (Ref. Fig. 401, Deatil B).

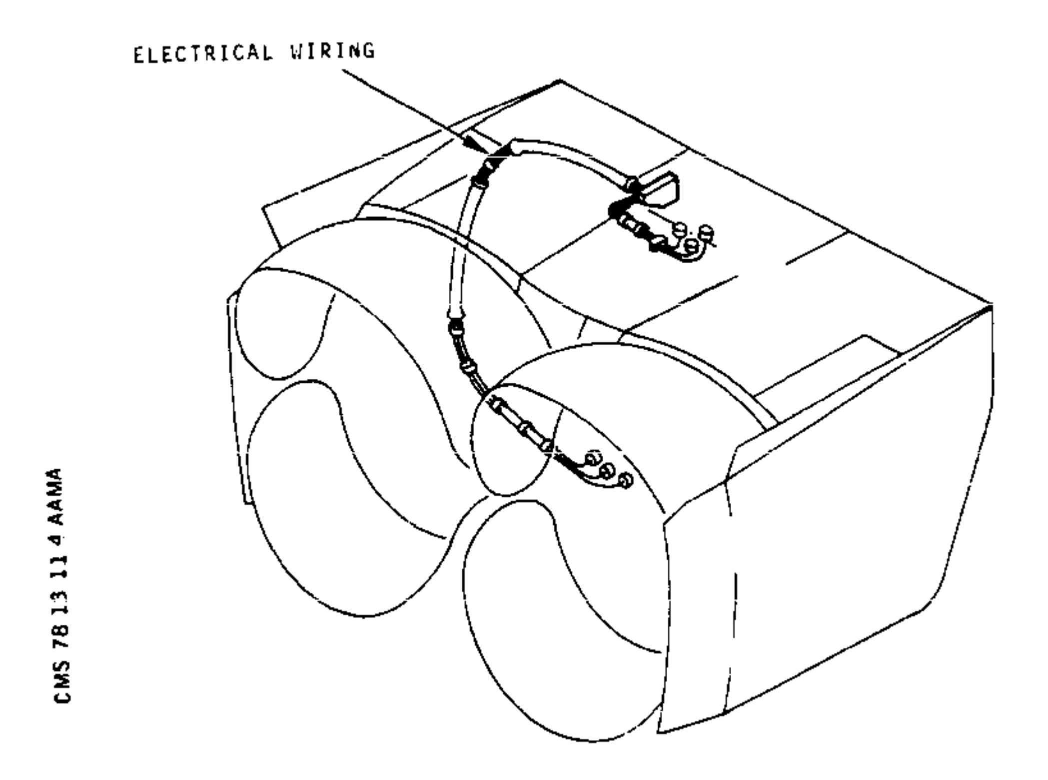
(7) Unlock and disconnect the two electrical connectors connecting the aircraft wiring to the electrical wiring box. (Ref. Fig. 401, Detail A).

(8) Unlock and disconnect the three Bucket Pneumatic Drive Actuator electrical connectors.

(9) Unscrew the self-locking nuts and bolts and remove

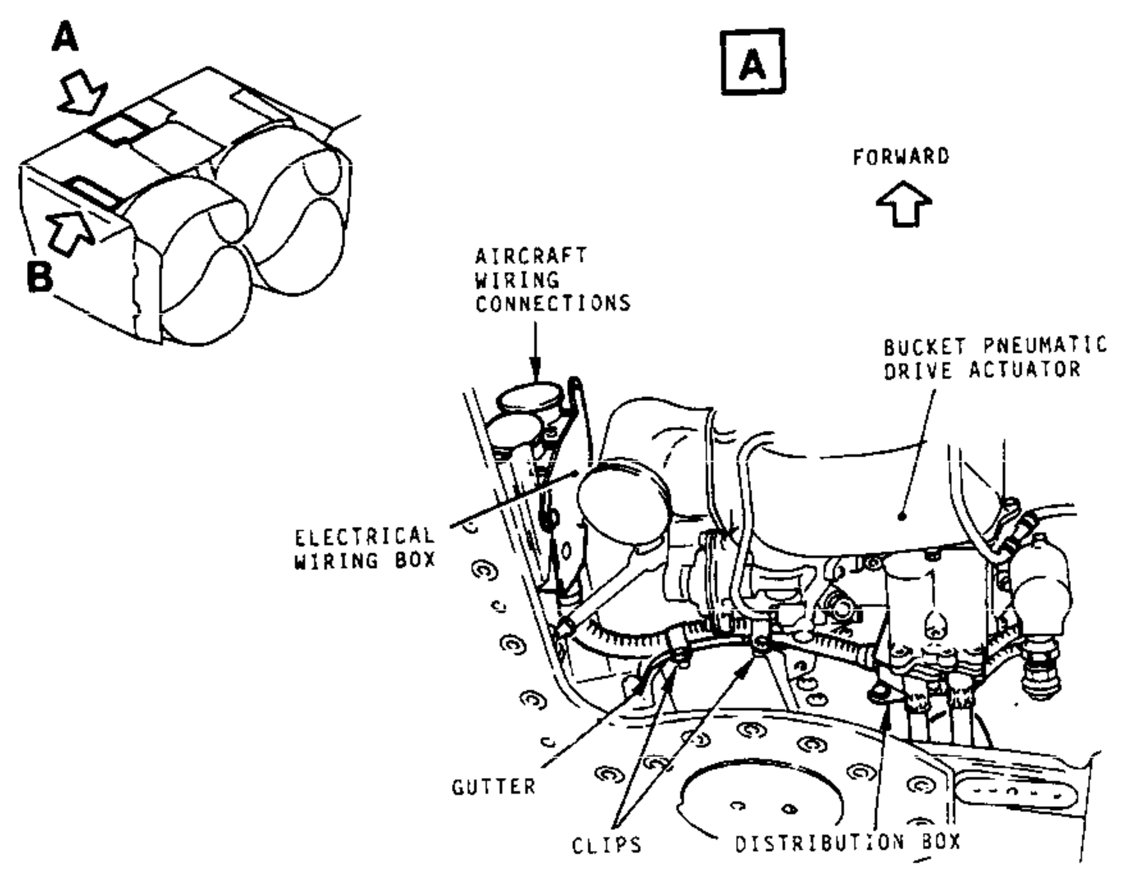


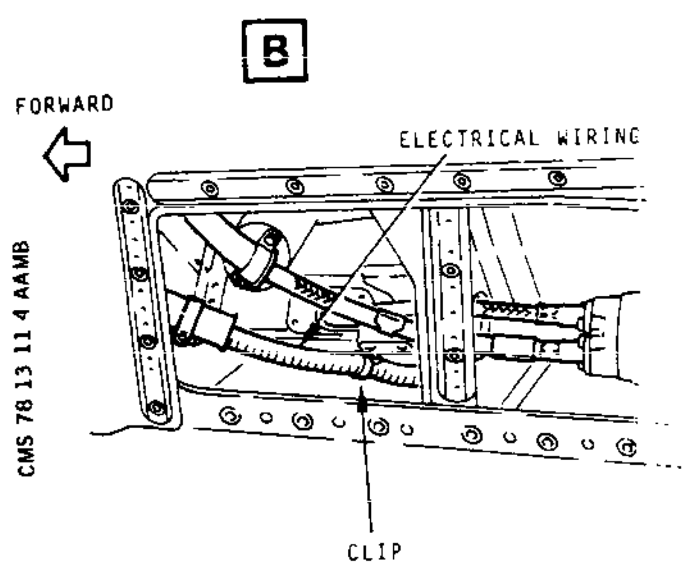




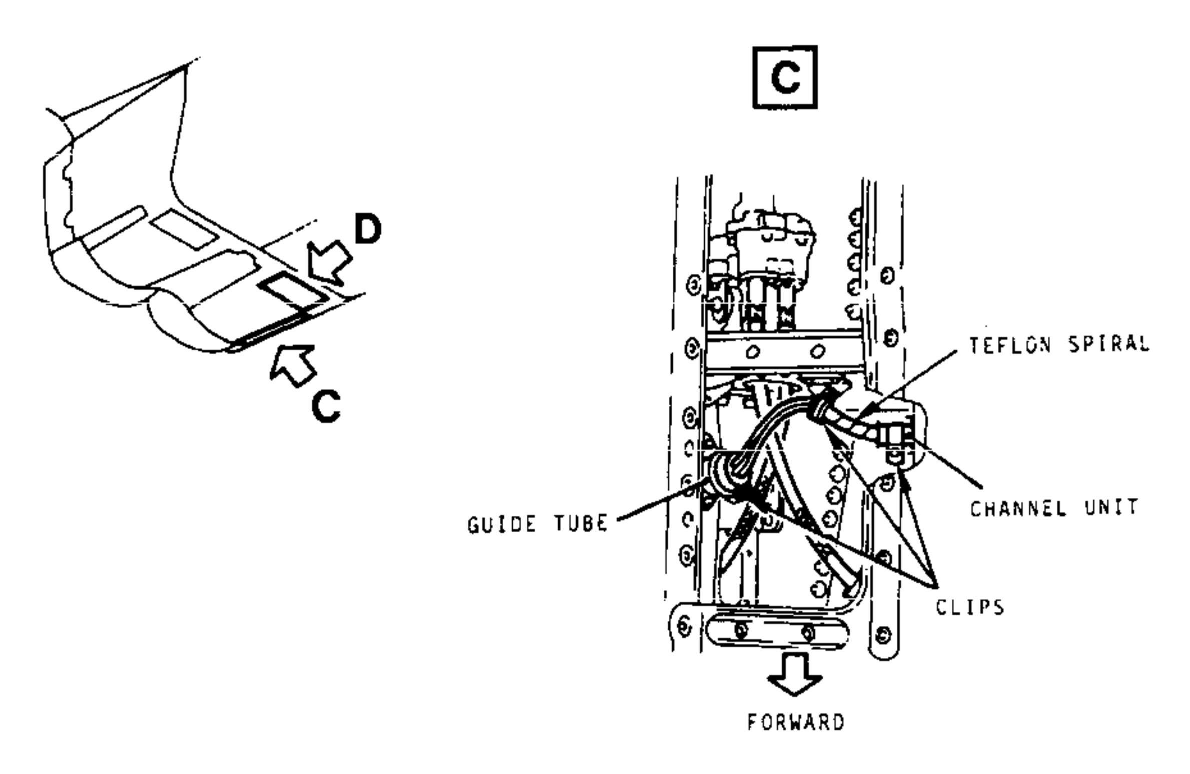
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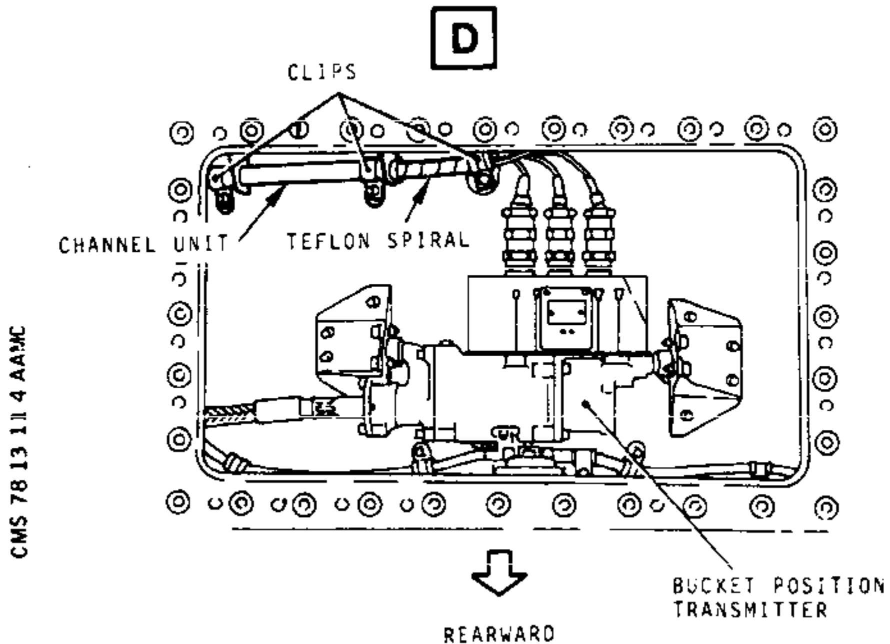
Electrical Wiring (Bays 1 & 3) -
Removal/Installation Sheet 1 of 3
Figure 401





Electrical Wiring (Bays 1 & 3) -
Removal/Installation Sheet 2 of 3
Figure 401





CMS 78 13 11 4 AAMC

Electrical Wiring (Bays 1 & 3) -
Removal/Installation Sheet 3 of 3
Figure 401

the two clips securing the electrical wiring to the gutter (Ref. Fig. 401, Detail A).

(10) Unscrew and remove the hexagonal head bolts which retain the box.

(11) Unscrew the self-locking nuts and remove the hexagonal head bolts which retain the distribution box (Ref. Fig. 401, Detail A).

(12) Carefully withdraw the Electrical Wiring from the guide tube and remove the wiring harness from the structure.

(13) Fit blanks to the Electrical Wiring connectors.

D. Installation of the Electrical Wiring.

(1) Introduce the sheathed harness in the guide tube up to the location of the bucket position transmitter (indicator).

(2) Fix the electrical wiring box and torque the hexagonal head bolts between 0.40 and 0.45 daN.m (2.95 and 3.30 lbf.ft). (Ref. Fig. 401, Detail A).

(3) Position the wiring leading to the Bucket Pnuematic Drive Actuator and secure the junction box using bolts and self-locking nuts. Torque tighten the bolts between 0.40 and 0.45 daN.m (2.95 and 3.30 lbf.ft).

(4) Position the two clips securing the electrical wiring to the gutter. Secure the clips using bolts and self-locking nuts. Torque tighten the bolts between 0.40 and 0.45 daN.m (2.95 and 3.30 lbf.ft).

(5) Connect the three Bucket Pneumatic Drive Actuator electrical connectors.

(6) Connect the two aircraft wiring electrical connectors to the electrical wiring box.

(7) In the upper lateral ballscrew gearbox housing, install the clip securing the electrical wiring. Torque tighten the bolt between 0.40 and 0.45 daN.m (2.95 and 3.30 lbf.ft). (Ref. Fig. 401, Detail B).

(8) Remove the plastic sheath covering the Bucket Position Transmitter (Indicator) electrical connectors and cut the binding retaining the electrical connectors.

(9) In the lower lateral Ballscrew Gearbox housing,install the clip securing the electrical wiring to the guide tube. Torque tighten the bolt and self-locking nut between 0.40 and 0.45 daN.m (2.95 and 3.30 lbf.ft). (Ref. Fig. 401, Detail C).

(10) Position the Teflon spiral on the electrical wiring and secure it, on one side, using the clip adjacent to the clip securing the electrical wiring to the guide tube. On the other side, use the clip adjacent to the Bucket Position Transmitter (Indicator) to secure the Teflon spiral. (Ref. Fig. 401, Details C and D).

(11) Position the Teflon sheathed wiring in the channel unit and secure it using three clips. Position the clips around the gutter. (Ref. Fig. 401, Details C and D).

(12) Torque tighten the bolts and self-locking nuts securing the five clips between 0.40 and 0.45 daN.m (2.95 and 3.30 lbf.ft).

(13) Connect the three Bucket Position Transmitter (Indicator) electrical connectors.

(14) Reset circuit breakers listed in Table 401 and carry out the bucket control system operational test as detailed in 78-00-00 (Page block 501, Paragraph 2.A-B-D-E-F-G).

(15) Lockwire the two aircraft wiring electrical connectors the three Bucket Pneumatic Drive Actuator electrical connectors and the three Bucket Position Transmitter (Indicator) electrical connectors.

E. Final Installation.

(1) Install the respective access panels to the Bucket Pnuematic Drive Actuator, the upper central Bucket Ballscrew Gearbox, the upper lateral Bucket Ballscrew Gearbox, the lower lateral Bucket Ballscrew Gearbox, the Bucket Position Transmitter (Indicator).

(2) Torque the attaching screws to 0.60 daN.m (53 lbf.in.) using a pneumatic vibration screwdriver preadjusted at the required torque value and equipped with an appropriate screwdriver head.

<u>CAUTION:</u> USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE

SCREWDRIVER HEAD.
USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

(3) Remove the placard displayed on the engine starting panel.

ELECTRICAL WIRING (BAYS 2 AND 4) - REMOVAL/INSTALLATION

1. General

This chapter describes the procedure for Removal/Installation of the electrical wiring attached to the engine bays 2 and 4 of the twin secondary nozzles.
This electrical wiring connects the bucket pneumatic drive actuator, the bucket crossfeed isolation valve, and the bucket position (indicator) to the aircraft wiring.

NOTE: For Removal/Installation of electrical wiring attached to engine bays 1 and 3, refer to 78-13-11, page block 401.

2. Removal/Installation of the Electrical Wiring (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Pneumatic vibration screwdriver (preadjusted at 0,60 daN.m, 53 lbf.in.) and the appropriate screwdriver head.	
Pneumatic impact wrench (unscrewing mode) ARO 8530 PC 1 and the appropriate screwdriver head.	
Torque wrench (0 to 3 daN.m, 0 to 265 lbf.in. in range)	
Plastic sheath	PRODUCT FILE CODE No. P457
Circuit breaker safety clips	

B. Prepare to Remove the Electrical Wiring.

(1) Electrically isolate the engine and exhaust assembly services indicated in table 401 by tripping the circuit breakers affecting engine in the nacelle upon which work is being carried out. Install breaker safety clips.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
	ENGINE No. 2			
	WIND DOWN CONT SUP 1	1-213	2K1101	F 4
	WIND DOWN CONT SUP 2	5-213	2K1108	C 1
	BUCKET CONT UNIT SUP	13-215	2K1132	G 14
	REV BUCKET POSN IND	1-213	2E121	B 7
	REV THRUST CONT	1-213	2K331	B 5
	REV THRUST ASOV CONT	1-213	2K334	D 7
	P.P. MGT LTS SUP	1-213	2E461	E 3
	ENGINE No. 4			
	WIND DOWN CONT SUP 1	5-213	4K1101	B 2
	WIND DOWN CONT SUP 2	1-213	4K1108	C 8
	BUCKET CONT UNIT SUP	14-216	4K1132	C 6
	REV BUCKET POSN IND	5-213	4E121	A 4
R	REV THRUST CONT	3-213	4K331	D 2
	REV THRUST ASOV CONT	3-213	4K334	G 4
R	P.P. MGT LTS SUP	5-213	4E461	D 2

Circuit Breakers
Table 401

WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE ON WHICH THE REMOVAL IS CARRIED OUT.

(2) Display a suitable placard on the engine starting panel, indicating that personnel are working on the engine and twin secondary nozzle area.

(3) Using a pneumatic impact wrench equipped with an appropriate screwdriver head, remove the respective access panels to the Bucket Pneumatic Drive Actuator, the Upper lateral Bucket Ballscrew Gearbox, the Upper Central Bucket Ballscrew Gearbox, the Lower Lateral Bucket Ballscrew Gearbox, the Bucket position Transmitter (Indicator).

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD. USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS. BEFORE CARRYING OUT ANY WORK, THE SECONDARY NOZZLE MUST BE LINED WITH RUBBER CARPETS TO AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES MUST ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

C. Removal of the Electrical Wiring.

(1) Unlock and disconnect the three Bucket Position Transmitter (Indicator) electrical connectors.

(2) Unscrew the self-locking nuts and bolts and remove the two clips securing the electrical wiring. (Ref. Fig. 401, Detail D).

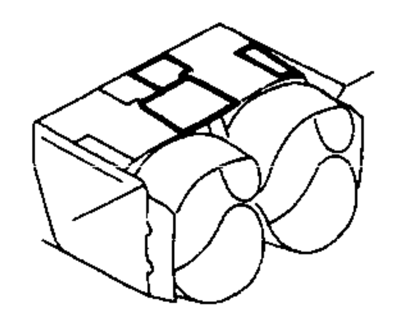
(3) In the lower lateral ballscrew gearbox housing, unscrew the self-locking nuts and bolts and remove the three clips securing the electrical wiring. (Ref. Fig. 401, Detail C).

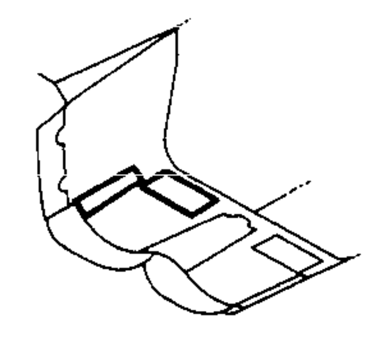
(4) Disengage the Teflon sheathed electrical wiring from the channel unit and remove the Teflon spiral. (Ref. Fig. 401, Details C and D).

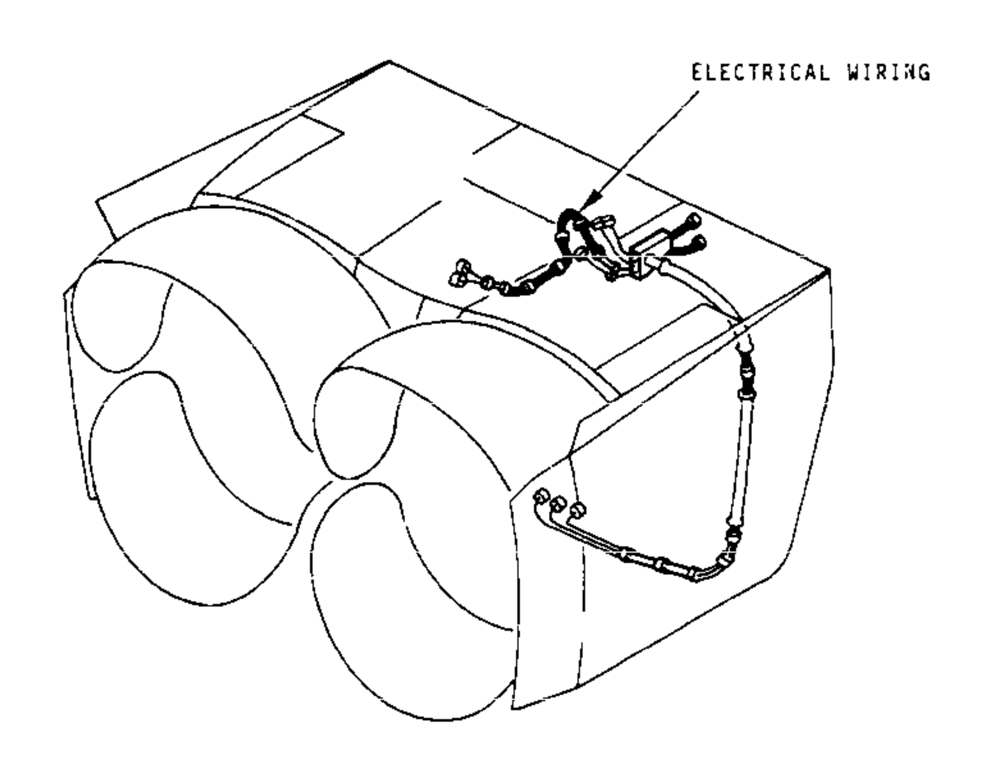
(5) On the Bucket Position Transmitter (Indicator) side of the harness, arrange the connectors so that they may be easily withdrawn through the harness guide tube. Retain them with a plastic sheath.

(6) In the upper lateral Ballscrew Gearbox housing, unscrew the bolt and remove the clip securing the electrical wiring (Ref. Fig. 401, Detail B).

(7) Unlock and disconnect the two electrical connectors connecting the aircraft wiring to the electrical wiring box (Ref. Fig. 401, Detail A).







CMS 78 13 12 4 AAMA

Electrical Wiring (Bays 2 & 4) -
Removal/Installation (Sheet 1 of 4)
Figure 401

A

FORWARD

AIRCRAFT WIRING CONNECTIONS

ELECTRICAL WIRING BOX

BUCKET PNEUMATIC DRIVE ACTUATOR

GUTTER

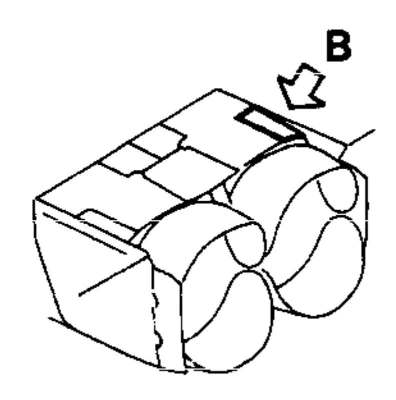
CLIPS

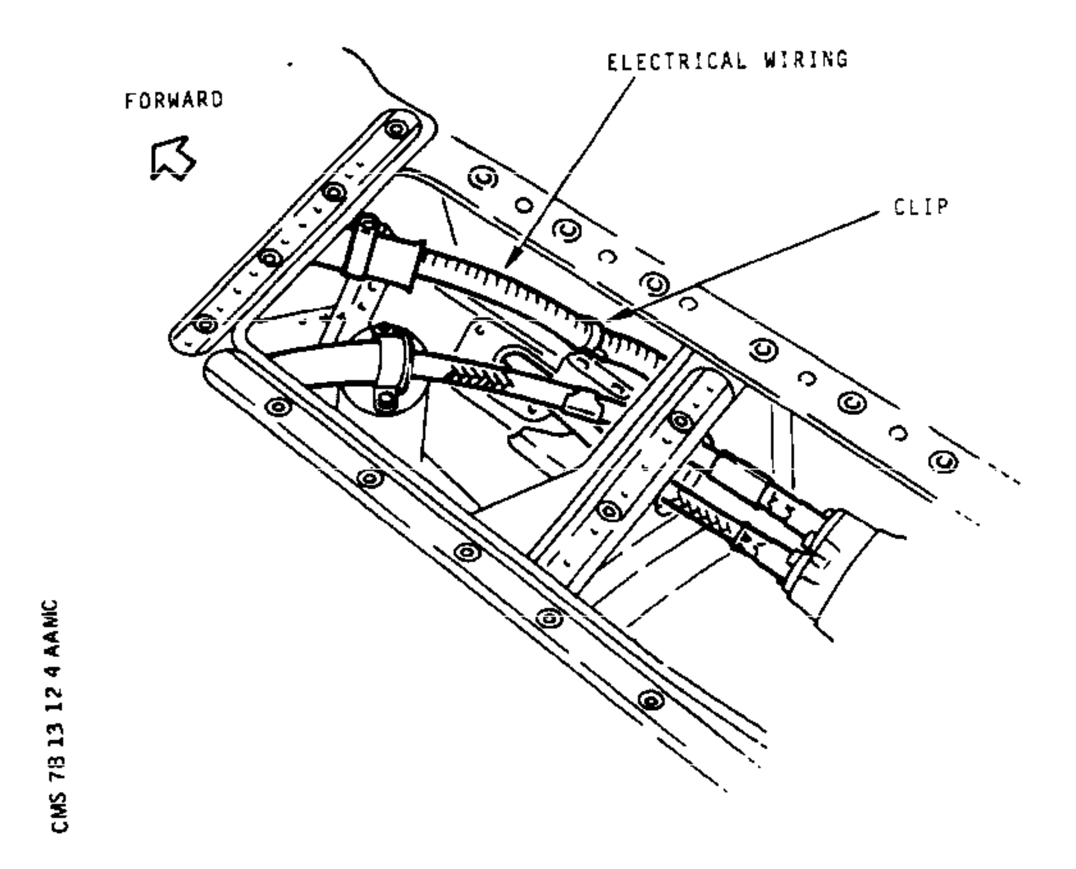
A

CROSSFEED ISOLATION VALVE

CMS 78 13 12 4 AAMB

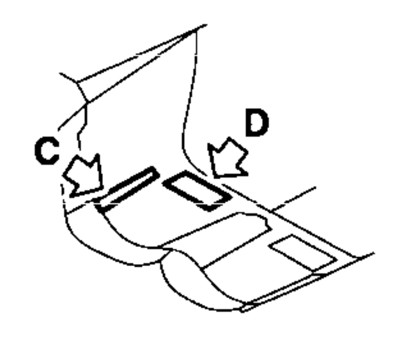
Electrical Wiring (Bays 2 & 4) -
Removal/Installation (Sheet 2 of 4)
Figure 401

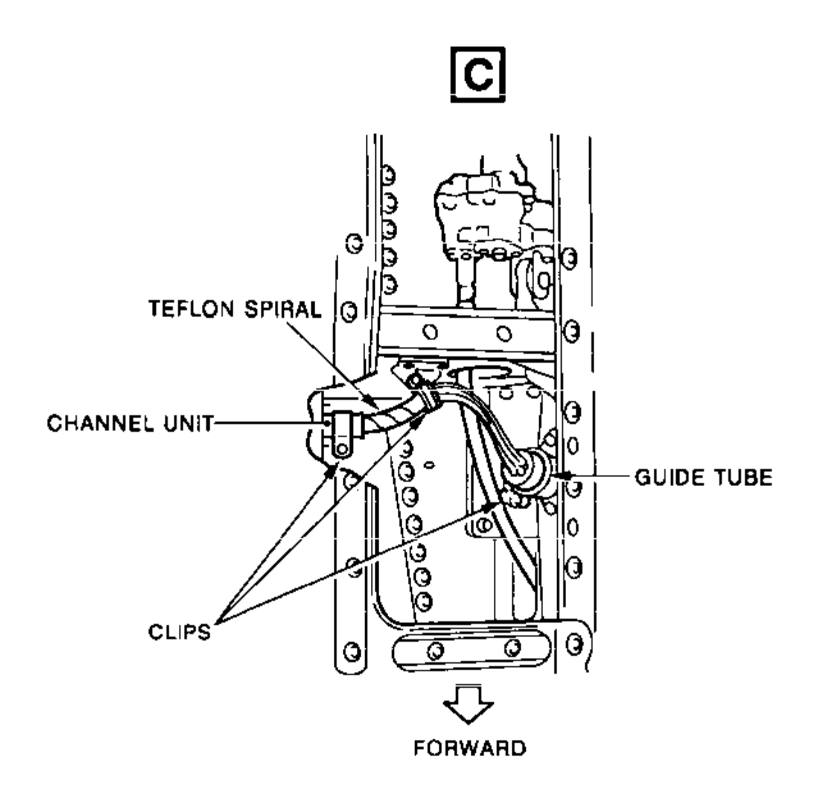


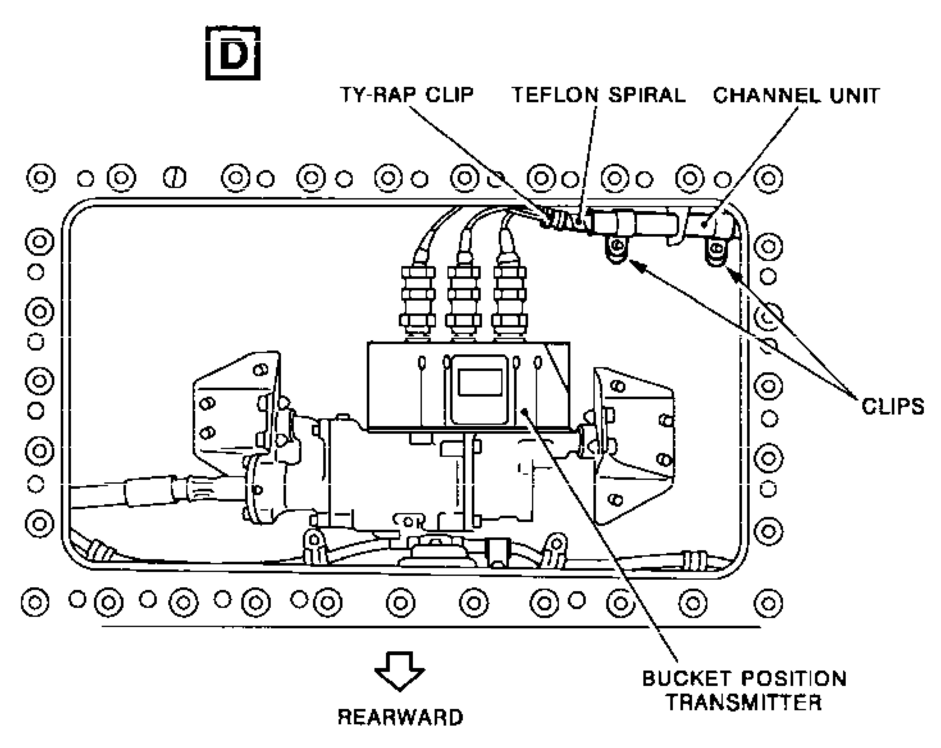


Electrical Wiring (Bays 2 & 4) -
Removal/Installation (Sheet 3 of 4)
Figure 401

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Electrical Wiring (Bays 2 & 4) -
Removal/Installation (Sheet 4 of 4)
Figure 401

R

(8) Unlock and disconnect the three Bucket Pneumatic Drive Actuator electrical connectors. (Ref. Fig. 401, Detail A).

(9) Unscrew the self-locking nuts and bolts and remove the three clips securing the electrical wirings to the gutter (Ref. Fig. 401, Detail A).

(10) Unscrew and remove the hexagonal head bolts which retain the distribution box. (Ref. Fig. 401, Detail A).

(11) Unlock and disconnect the two Crossfeed Isolation Valve connectors (Ref. Fig. 401, Detail A).

(12) Unscrew the self-locking nuts and bolts and remove the eight clips securing the Crossfeed Isolation Valve electrical wiring. (Ref. Fig. 401, Detail A).

(13) Carefully withdraw the electrical wiring from the guide tube and remove the wiring harness from the structure.

(14) Fit blanks to the electrical wiring connectors.

D. Installation of the Electrical Wiring.

(1) Introduce the sheathed harness into the guide tube up to the location of the Bucket Position Transmitter (Indicator).

(2) Position correctly the wirings leading to the Bucket Pneumatic Drive Actuator and to the Crossfeed Isolation Valve (Ref. Fig. 401, Detail A).

(3) Install the Electrical Wiring Box and torque tighten the hexagonal head bolts between 0.40 and 0.45 daN.m (2.95 and 3.30 lbf.ft). (Ref. Fig. 401, Detail A).

(4) Position the three clips securing the Electrical Wirings to the gutter. Secure the clips using bolts and self-locking nuts. Torque tighten the bolts between 0.40 and 0.45 daN.m (2.95 and 3.30 lbf.ft) (Ref. Fig. 401, Detail A).

(5) Connect the three Bucket Pneumatic Drive Actuator electrical connectors.

(6) Connect and lock the two electrical connectors connecting the aircraft wiring to the electrical wiring box. (Ref. Fig. 401, Detail A).

(7) Position the eight clips securing the Crossfeed Isolation Valve Wiring. Secure the clips using bolts and self-locking nuts. Torque tighten the bolts between 0.40 and 0.45 daN.m (2.95 and 3.30 lbf.ft). (Ref. Fig. 401, Detail A).

(8) Connect the two Crossfeed Isolation Valve Electrical connectors.

(9) In the upper lateral Ballscrew Gearbox housing, install the clip securing the Bucket Position Transmitter (Indicator) electrical wiring. Torque and tighten the bolt securing the clip between 0.40 and 0.45 daN.m (2.95 and 3.30 lbf.ft). (Ref. Fig. 401, Detail B).

(10) Remove the plastic sheath covering the Bucket Position Transmitter (Indicator) electrical connectors and cut the binding retaining the electrical connectors.

(11) In the lower lateral Ballscrew Gearbox housing, install the clip securing the electrical wiring to the guide tube. Torque tighten the bolt and self-locking nut to between 0.40 and 0.45 daN.m (2.95 and 3.30 lbf.ft). (Ref. Fig. 401, Detail C).

(12) Position the Teflon spiral on the electrical wiring and secure it, on one side, using the clip adjacent to the clip securing the electrical wiring to the guide tube; on the other side, use the Ty-Rap clip adjacent to the Bucket Position Transmitter (Indicator) (Ref. Fig. 401, Details C and D).

(13) Position the Teflon sheathed wiring in the channel unit and secure it using two clips. Position the clips around the gutter. (ref. Fig. 401, Detail D).

(14) Torque tighten the bolts and self-locking nuts securing the four clips between 0.40 and 0.45 daN.m (2.95 and 3.30 lbf.ft).

(15) Connect the three Bucket Position Transmitter (Indicator) electrical connectors.

(16) Reset circuit breakers listed in Table 401 and carry out the Bucket Control system operational test as detailed in 78-00-00 (Page block 501, Paragraph 2.A-B-D-E-F-G.

(17) Lockwire the two aircraft wiring electrical connectors, the three Bucket Pneumatic Drive Actuator

electrical connectors, the two Crossfeed Isolation Valve electrical connectors and the three Bucket Position Transmitter (Indicator) electrical connectors.

E. Final Installation.

(1) Install the respective access panels, to the Bucket Pneumatic Drive Actuator, the upper central Bucket Ballscrew Gearbox, the upper lateral Bucket Ballscrew Gearbox, the lower lateral Bucket Ballscrew Gearbox, the Bucket Position Transmitter (Indicator).

(2) Torque the fitting screws to 0.60 daN.m (53 lbf.in.) using a pneumatic vibration screwdriver preadjusted at the required torque value and equipped with an appropriate screwdriver head.

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.
USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

(3) Remove the placard displayed on the engine starting panel.

THRUST REVERSER - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001)

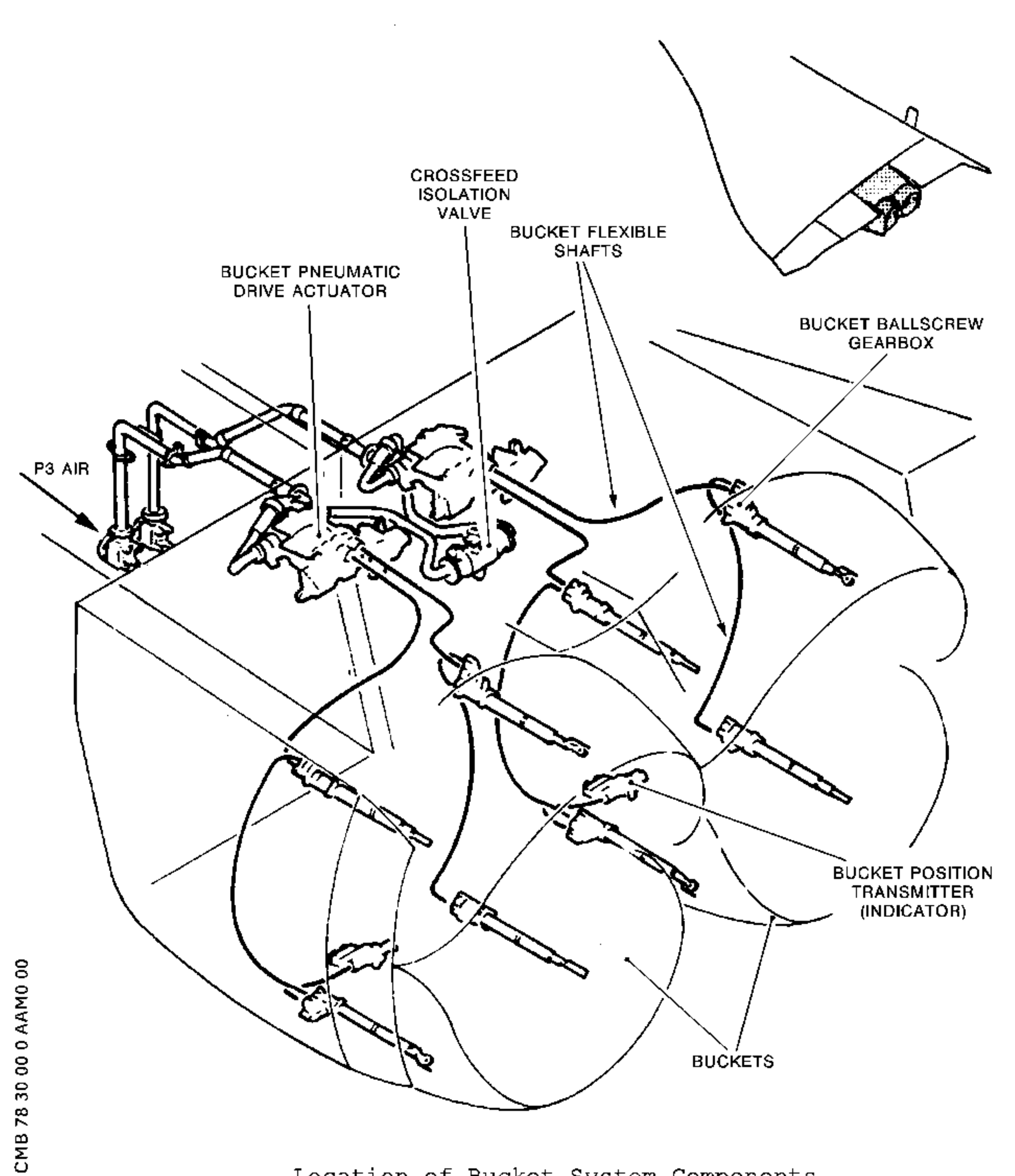
The bucket system provides optimum performance from the propulsive assembly in all flight configurations by controlling the expansion of the exhaust gases and thrust reverse on flight deceleration and landing.

The complete aircraft bucket control system is essentially composed of two nozzle angle scheduling units and four nozzle and thrust reverser controllers (one per engine) located in the flight compartment equipment racking. Each exhaust assembly is equipped with a bucket pneumatic drive actuator, four ball-screw gearboxes actuating two buckets, five flexible shafts and a bucket position transmitter (indicator). Each secondary nozzle is equipped with a crossfeed isolation valve which is used when reverse in flight is selected.

The nozzle angle scheduling unit (NASU) provides the bucket position control signals in the modulation zone, namely between 0 and 21 degrees. The law chosen for the bucket adjustment is function of mach number. The NASU No. 1 controls the engines No. 1 and 4 bucket systems and the NASU No. 2 controls the engines No. 2 and 3 bucket systems. The nozzle and thrust reverser controller controls the bucket pneumatic drive actuator in relation with the error signal resulting from the difference between the control signal from the NASU and the bucket system feedback signal. It also controls thrust reverse when it receives the corresponding signal from the pilot throttle lever.

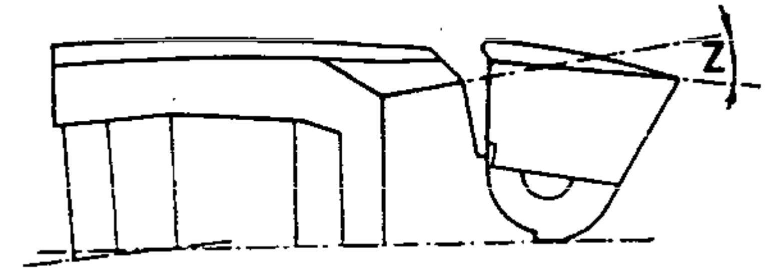
The thrust reverser actuation system is normally positioned at the take-off position, which is at a bucket position of 21 degrees from fully retracted (from straight through flow position). In the fully extended position (thrust reverse position), the thrust reverser actuation system provides reverse thrust during both flight and ground operation. In the modulating range, the buckets of the thrust reverser system provide a variable area secondary nozzle for the engine. During supersonic cruise, the thrust reverser actuation system is fully retracted (stow position). The thrust reverser system is designed in such a manner that loss of electrical power will return the system to the zero degree position. If pneumatic power is lost, the system will remain at last position prior to power loss. Each thrust reverser actuation system consists of a pneumatic drive actuator, five flexible shafts, four ballscrew gearboxes, a position transmitter (indicator) and a nozzle and thrust

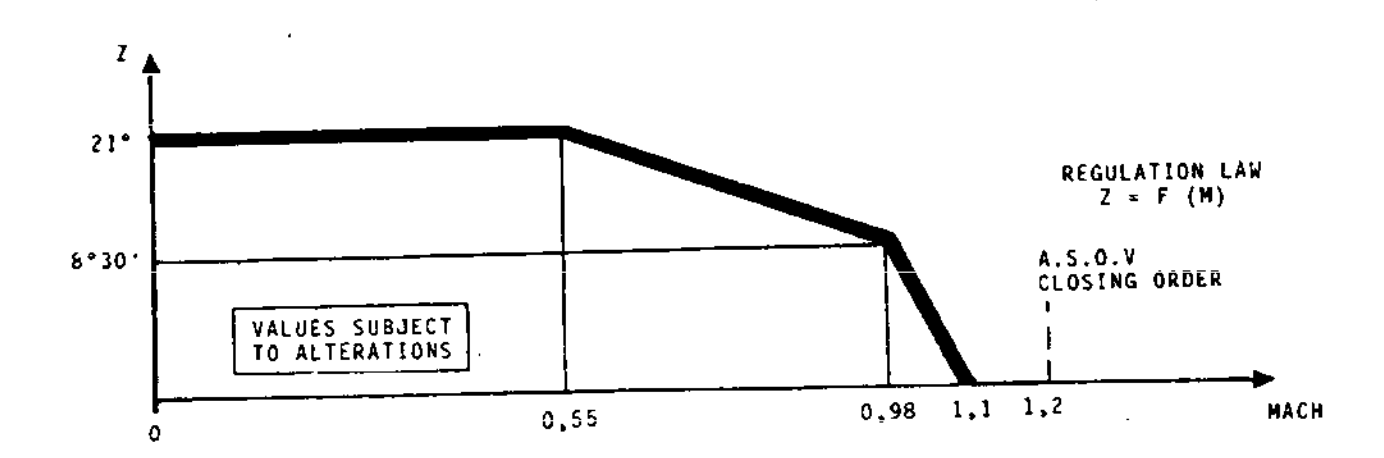
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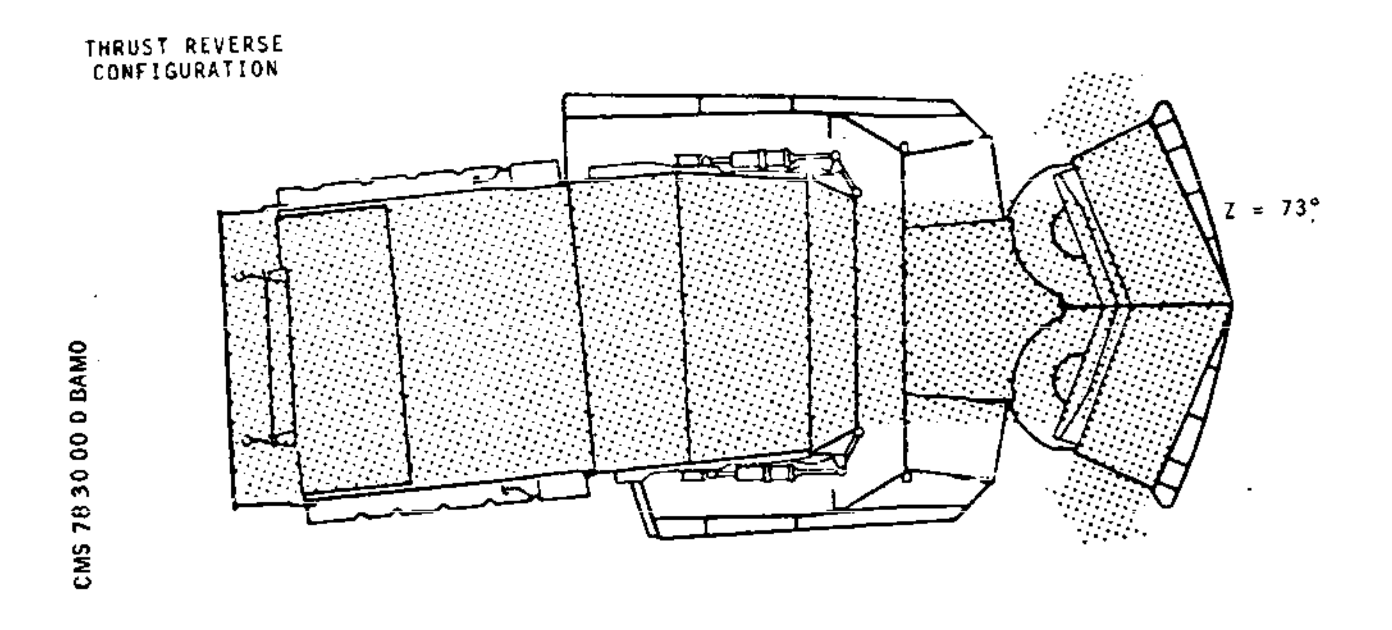


Location of Bucket System Components
Figure 001

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Bucket System Operation and Configurations
R Figure 002

reverser controller assembly.

The bucket pneumatic drive actuator provides controlled power to actuate the buckets in modulating range and to move them in either the forward and reverse positions. The illustration (Ref. Fig. 002) shows how the Z angle defines the bucket position. When Z is null, buckets are in straight through flow hard against stops; when Z equals 73 degrees, buckets are in thrust reverse position.

The bucket ballscrew gearboxes transform the rotation of the bucket pneumatic drive actuator into longitudinal motion. The bucket position transmitter (indicator) is made up of
R mechanism which actuates reverse thrust indicating switches,
R engine power auto reduction switches and safety switches.

2. Bucket Pneumatic Drive Actuator (Ref. Fig.003 and 004)

A. Description

The bucket drive actuator mainly includes power and slaving elements. The power elements are the following: inlet shut-off valve (15), directional control valve (13), bi-directional three lobes air motor (11) to which is connected a disk-type brake (7) actuated by a pneumatic actuator (8).

The slaving elements are the electro-magnetic control valve (16) the null/stow shut-off servo-valve (9) the zero shut-off valve (1) and associated servo-valve (20), the directional control valve actuator (22) and associated centering spring (18), the pressure control regulator (2), the fluidic low speed controller (24) and associated control servo, the feed back nut and screw actuating the retract and reverse snubbing poppets (5 and 6) and the LVDT position detector (4). Two manual lockouts (10 and 17) equip the bucket pneumatic drive actuator.

The direction control valve actuator (22) incorporates a translating piston enclosed in a chamber, which limits travel in both directions. The translating piston is internally threaded for engagement with the threaded shaft of the feed back screw, thus converting rotary to translational motion. The translating piston is mechanically linked to the direction control valve centering spring (18) and direction control valve (13). The translating nut of the direction control valve actuator divides the enclosing chamber into two halves.

The right hand half-chamber bears the slaving air pressure increases which control the thrust reverse. The direction

MOUNTING FLANGE

ELECTRO-MAGNETIC CONTROL VALVE (TORQUE MOTOR)

SYSTEM MANUAL LOCKOUT AND SHIPPING LOCK

OUTPUT SHAFTS

SECURITY SOLENOID

MOUNTING FLANGE

AIR INLET SHUTOFF VALVE (ASOV)

SECURITY SOLENOID CONNECTOR

DIRECTIONAL CONTROL VALVE AND EXHAUST PORT

LVDT POSITION DETECTOR CONNECTOR

MOUNTING FLANGE

ZERO DEGREE POSITION INDICATOR

DIRECTION OF DEPLOY ROTATION

IDENTIFICATION PLATE

REVERSE THRUST MANUAL LOCKOUT

CMS 78 30 00 D CAMO

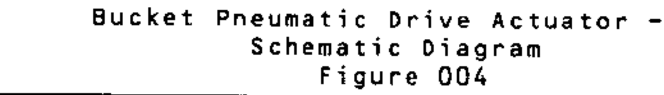
Bucket Pneumatic Drive Actuator
Figure 003

R

CMS 78 30 00 0 DAMO

(1) ZERO DEGREE SHUTOFF VALVE
(2) CONTROLE PRESSURE REGULATOR
(3)
(4) LVDT POSITION DETECTOR
(5) REVERSE SNUBBING POPPET
(6) RETRACT SNUBBING POPPET
(7) BRAKE
(8) BRAKE PNEUMATIC ACTUATOR
(9) NULL/STOW SHUT-OFF SERVO-VALVE
(10) SYSTEM MANUAL LOCKOUT
(11) AIR MOTOR
(12)
(13) DIRECTION CONTROL VALVE
(14)
(15) INLET SHUT-OFF VALVE
(16) ELECTRO-MAGNETIC CONTROL VALVE (TORQUE MOTOR)
(17) THRUST REVERSE MANUAL LOCKOUT
(18) DIRECTIONAL CONTROL VALVE CENTERING SPRING
(19) TO DIRECTION CONTROL VALVE
(20) 0° SHUTOFF SERVO-VALVE
(21)
(22)
(23)
(24) FLUIDIC LOW SPEED CONTROLLER
(25) CHECK-VALVE
(26)

DIRECTION CONTROL VALVE ACTUATOR
SPEED CONTROL SERVO
TO BRAKE
FEEDBACK SCREW
LVDT
0°
REVERSE THRUST
FEEDBACK NUT
VENT
INLET
SECURITY SOLENOID
S2 SIGNAL
EXHAUST
MODULATION AND THRUST REVERSE SIGNAL
ANGLE Y


Bucket Pneumatic Drive Actuator -
Schematic Diagram
Figure 004

R

EFFECTIVITY: ALL

BA

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control valve actuator piston moves then towards the left. When the differential pressures change direction in these two half-chambers, the mechanism controls the rotation of the direction control valve (13) in the straight-through flow direction. Both halves of the direction control valve actuator chamber are interconnected through restricted passages.

B. Operation of the bucket pneumatic drive actuator.

The pneumatic drive actuator performs the buckets position modulation between 0 and 21 degrees and move the buckets in either the forward and reverse positions. In the dormant state of the modulation range, there is a zero voltage supplied to the electro-magnetic control valve (16) and security solenoid (12). The poppets (5 and 6) are closed. The shaft (19) being in middle angular position, the inlet shut-off valve (15) is open and the brake (7) is in disengaged position.

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When flight conditions change, the NASU controls a variation in the buckets position Z. The nozzle and thrust reverser controller (NTRC) then delivers a signal to the electro-magnetic control valve (16). If this signal corresponds to an increase in the Z angle, the electro-magnetic control valve wand (16) breaks the pressure balance existing on each side of the direction control valve actuator (22) piston. The piston is drawn toward the low pressure side. The P3 air then supplies the air motor which rotates in either direction according to that in which the direction control valve (13) has rotated.

The direction control valve (13) continues to open. The opening angle is proportional to the pressure difference applied to the direction control valve actuator (22). As the air motor rotation proceeds, the feed back nut acts on the LVDT position detector (4) the output signal of which is fed into the NTRC. It is compared to the initial control signal from the NASU, the resulting different is amplified and activates the pneumatic drive actuator through the electro-magnetic control valve (16).

When the bucket position approaches that initiated by the NASU, the electro-magnetic control valve action diminishes as well as the pressure differential applied to the direction control valve actuator (22). The shaft (19) returns progressively to the initial position. When shaft (19) reaches the null position, the direction control valve (13) is nulled, blocking airflow to the motor. When thrust reverse is ordered, the control system operates in open loop.

The LVDT position detector does not then operate. The S3 signal which reaches the NTRC positions the electro-magnetic control valve (16) "deploy against stop". The initial operational sequences of the bucket pneumatic drive actuator are the same as those explained above. The drive actuator rotation speed is limited to a maximum value. This is effected by the direction control valve actuator (22) itself. The diametral importance of both half-chambers is such that the piston displacements brought about by feed back shaft rotation lead to a pressure differential which counters the pressure which initiated the original direction control valve (13) rotation.

The impact speed of the system at the end of run is also limited as follows: when the reverse snubbing poppet (5) opens on contact with the stop (23), the fluidic low speed controller starts operating. It then slaves the differential pressure acting on the direction control valve actuator (22) in relation with the drive actuator rotation speed, thus limiting the system displacement speed at the moment preceeding the bucket ball-screw gearboxes coming hard against stops. During the whole of thrust reverse operation the pneumatic drive actuator remains in the same state as during displacement described above. The inlet shut-off valve (15) remains open and the air motor (11) keeps up its torque in the thrust reverse direction.

The return of the buckets to straight through flow position is controlled by the suppression of signal S3 in the NTRC. The return to the bucket position regulation in closed loop is thus achieved and the electro-magnetic control valve (16) immediately returns to "stow" against stops. The air motor stops when the bucket Z angle corresponds to that ordered by the S1 signal. The 0 degree position is applied to supersonic flight for mach number exceeding 1.10. On nearing 0 degree, a load system of the actuation system comes into operation as follows: the S1 signal corresponding to 0 degree is positive and of some 0.55 volts. As the mach value increases, S1 continues to decrease toward zero. The electro-magnetic control valve (16) controls the further opening of the buckets, thus the displacement of the direction control valve actuator (22) toward the right consequently results in the rotation of the direction control valve (14). The signal continues to decrease and the direction control valve actuator (22) piston

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moves toward the right actuating the zero degree shut-off valve (1). The direction control valve (11) remains open in the forward thrust direction. The zero degree shut-off valve (1) closing, the line (3) is pressurized, the brake (7) is engaged and the zero degree shut-off servo-valve (20) closes to interrupt the air supply to the fluidic low speed controller to minimise airflow during high mach number cruise.

C. Safety devices

The thrusts reverse manual lockout (17), when engaged, limits the operation of the pneumatic drive actuator in the modulation range. If for any reason the motor should operate in the thrust reverse direction, the direction control valve actuator (22) piston is brought to rest by its stop (21). The feed back shaft continues to rotate inside the piston which is at rest. The shaft (26) travels longitudinally and controls the direction control valve (13) in the straight through flow direction. This permits the keeping in service on an aircraft of a defective bucket pneumatic drive actuator not capable of fulfilling all its functions. Thus locked, the drive actuator can supply modulation functions but in no case will be capable of actuating the buckets beyond 37 degrees. It is thus inoperative in reverse thrust.

The system manual lock (10) immobilizes the actuator simultaneously locking the air motor rotors (11) and holding the inlet shut-off valve (15) closed.

The security solenoid (12) is located on the air line controlling the inlet shut-off valve (15). It is
R energized by the NTRC (BCU) 27deg safety relay and/or by
R the bucket position transmitter (indicator) 27deg switch if
R for any reason the buckets should travel in the thrust reverse direction when the controls at the pilot station are in straight through flow position. In addition, signal is applied to the security solenoid (12) by the NASU at Mach Number higher than 1.2 to reinforce the closing of the inlet shut-off valve (15).

3. Bucket Position Transmitter (Indicator) (Ref. Fig. 005)

The position transmitter consists essentially of input shaft, a gear train, switch actuating mechanism, a reverse thrust indication switch, engine power reduction switches, translating indication switches and connectors.

The gear train, which runs off the input shaft is provided with an internal stop, and engages the switch actuating

mechanism which is comprised of a cam, actuators, clevises, and pins. The switch actuating mechanism contacts the reverse thrust indication switch, the engine power auto
R reduction switches the air-shut-off valve closing switch and
R translating indication switches. The connectors of the
R bucket position transmitter (indicator) are electrically
R connected to the aircraft electrical system.

4. Bucket Ballscrew Gearboxes (Ref. Fig. 006)

Each ballscrew gearbox is mechanically linked to the flexible shaft assemblies of the thrust reverser actuation system by means of input shafts, and by flexible shaft assembly mounting pads provided on the gearbox housing. The gearbox housing also incorporates a rod end bearing mounting pad.

The messhing input shafts are provided with bearings and seals. One input shaft engages a bearing-mounted gearshaft, which shares a common axis with a second gearshaft. This second gearshaft engages a third gearshaft. The third gearshaft is provided with bearings and a seal, and is secured to a shaft assembly by means of a nut. The shaft assembly extends into the ballscrew actuator and engages the ballscrew.

The ballscrew actuator incorporates, in addition to the ballscrew, a lubrication access hole, stop assembly with torque restraint arm, and rod end bearing. The ballscrew actuator engages the thrust reverser mechanism at the end incorporating the rod end bearing.

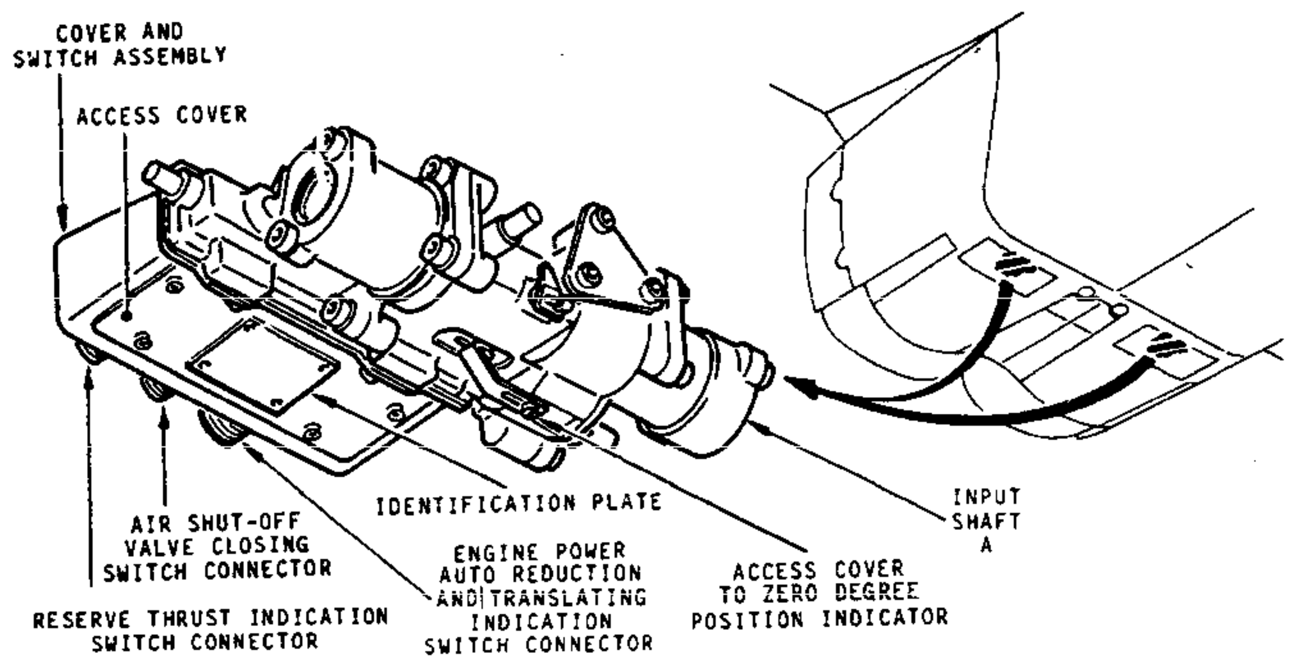
5. Flexible Shafts (Ref. Fig. 007)

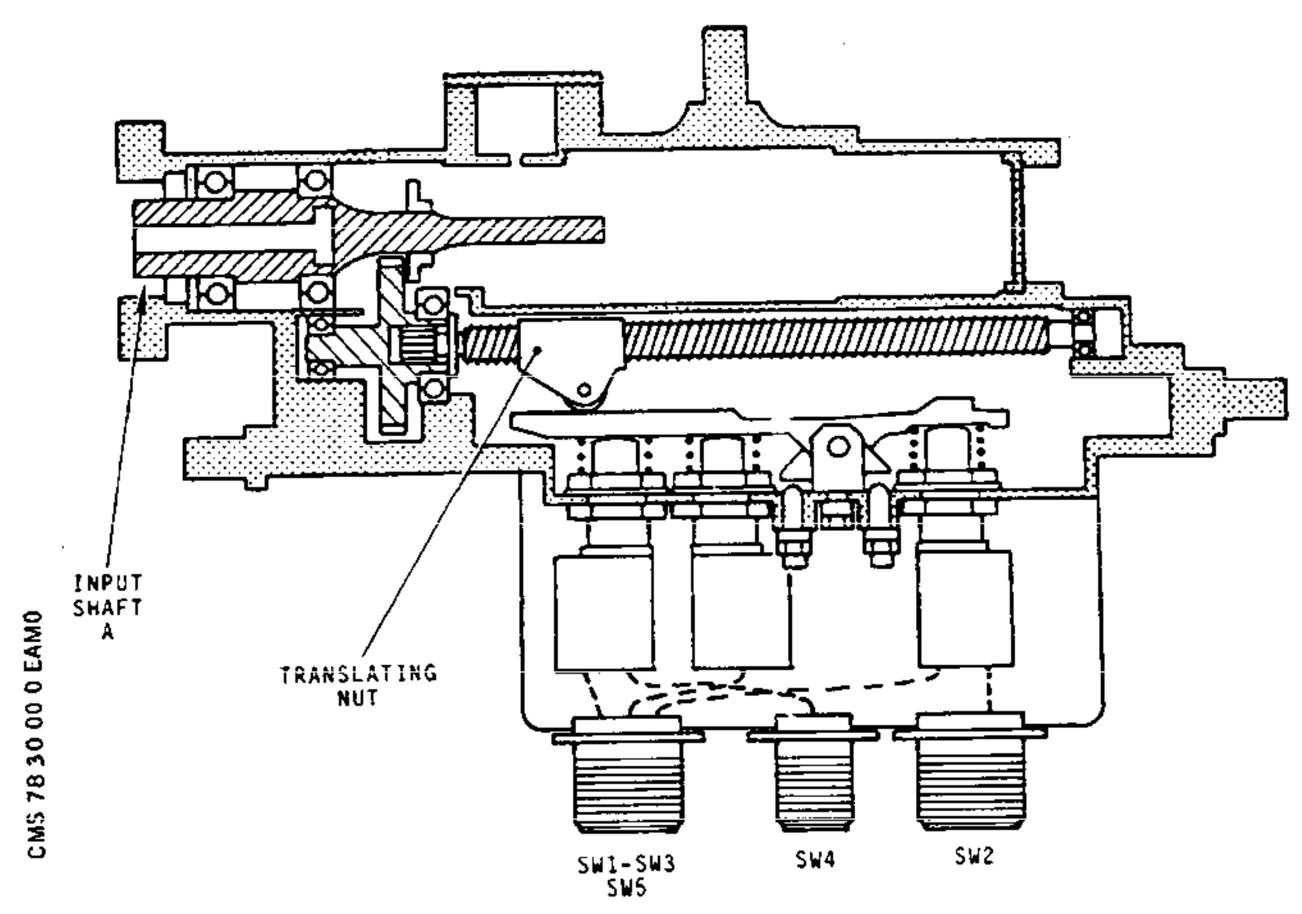
The flexible shafts mechanically link the pneumatic drive actuator, ballscrew gearboxes, and position transmitter (indicator). Each flexible shaft incorporates a power core and casing assembly. The power core consists of wire encased in stainless steel tubing. The casing assembly incorporates mounting flanges. The flexible shafts differ in length.

6. Nozzle and Thrust Reverser Controller (Ref. Fig. 008)

R The nozzle and thrust reverser controller (NTRC) is located in
R the flight compartment equipment racking. This fully transistorized unit is permanently supplied with 115 VAC, 400 Hz. A test connector is fitted on the front face.

It provides an electrical error signal to the pneumatic drive actuator torque motor by comparison of the system position signal from the LVDT position detector with the position command signal S1. It elaborates an electronic





CMS 78 30 00 0 EAM0

Bucket Position Transmitter (Indicator)
Figure 005

R

LUBRIFICATION ACCESS HOLE
BALLSCREW
TORQUE RESTRAINT ARM
ROD END BEARING MOUNTING PAD
GEARBOX HOUSING
INPUT SHAFTS
BALLSCREW ACTUATOR HOUSING
FLEXIBLE SHAFT ASSEMBLY MOUNTING PAD
GEARSHAFT
STOP ASSEMBLY
BALLSCREW ACTUATOR ASSEMBLY
LUBRIFICATION ACCESS HOLE
BALLSCREW
ROD END BEARING
ROD END BEARING MOUNTING PAD
GEARSHAFT
SHAFT ASSEMBLY
STOW STOP

CMS 78 30 00 0 FAMO

Bucket Ballscrew Gearbox
Figure 006

R

MOUNTING FLANGE

CASING

CORE

SHAFT

CMS 78 30 00 0 GAM0

Flexible Shafts
Figure 007

R

IDENTIFICATION PLATE

J1 CONNECTOR

J2 CONNECTOR

CMS 78 30 00 0 HAM0

115 V

REVERSE THRUST ORDER

"GO" LIGHT

POWER SUPPLY CIRCUITRY

15 V DC

10 V DC REF REGULATOR

SW3 TRIP CIRCUIT

V. REF

REVERSE RELAY

V. REF

ASOV TRIP CIRCUIT

V. REF

ASOV

TORQUE MOTOR

TORQUE MOTOR CURRENT DRIVE

E1

LVDT

E2

E3

8.P.D.A

VOLTAGE CONTROLLED OSCILLATOR

600 Hz GENERATOR OSCILLATOR

V. REF

LVDT FAILURE CIRCUIT

E2 + E3 BUFFER

DEMODULATOR

E2 - E3 BUFFER

DEMODULATOR

E4

E4 SIGNAL CONDITIONING

POSITION FEEDBACK

VELOCITY FEEDBACK

(POSITION)
(INDICATOR)

SI

SIGNAL CONDITIONING

LEAD-LAG COMPENSATION

OFFSET 10/K2

Nozzle and Thrust Reverser Controller
Schematic Diagram (Simplified)
Figure 008

R

saturation signal to the torque motor in response to the thrust reverse command signal S3 and a position signal E4 by amplification of a signal from the LVDT position detector to be fed into the bucket position indicator. It provides a 28V safety signal to close the air shut-off valve when the LVDT output voltage corresponds to a bucket angular position greater than 27 degrees with the thrust reverse not selected and when a failure occurs on the 115V,400 Hz supply. The nozzle and thrust reverser controller also provides a temperature compensation and control of the LVDT and an electrical compensation for an optimum system dynamic performance.

7. Crossfeed Isolation Valve

A. General

The crossfeed isolation valve is located between left and right engine pairs on the aircraft. When reverse in flight is selected, the valve admits compressor bleed-air pressure from the higher bleed pressure engine to the lower bleed pressure engine for use in the thrust reverser actuation system.

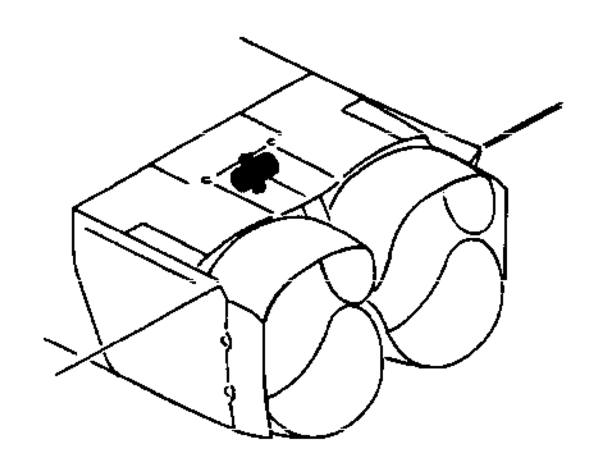
B. Description (Ref. Fig. 009)

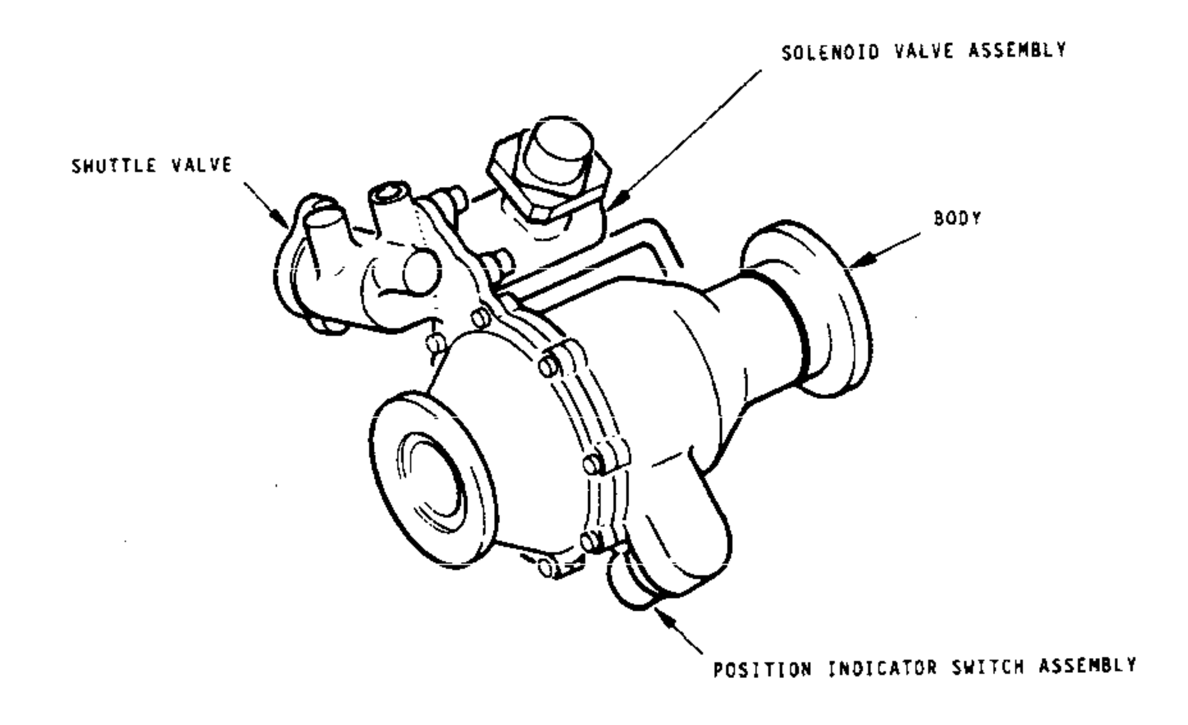
This valve is a normally closed, in line-poppet-type, solenoid-controlled, pneumatically-actuated shut-off valve capable of functioning with air flow in either direction. The valve consists of a solenoid valve assembly, position indicator switch assembly and two bolted bodies.

The solenoid valve assembly is mounted on top of the smaller body and consist essentially of a solenoid assembly and valve assembly. The solenoid assembly consists of an electro-magnet assembly and armature. The valve assembly consists of two seats and a ball. The electro-magnet assembly is provided with an electrical receptable for aircraft electrical connection. When energized, the electro-magnet assembly is capable of moving the armature which in turn moves the ball.

The position indicator switch assembly is mounted on the bottom of the larger body and consists of a micro switch and electrical receptacle for aircraft electrical connection. The micro switch is tripped or released by a lever acting on the switch actuator.

The two bolted bodies house a piston poppet, a free floating shuttle valve and a spring. In addition, the bodies provide mounting points for the solenoid valve





R Crossfeed Isolation Valve
Figure 009

assembly and position indicator switch assembly.

C. Operation (Ref. Fig. 010)

When airflow is directed to ports A and B, the shuttle valve will respond to the higher differential pressure. This pressure is directed to chamber C through the solenoid valve assembly. If the piston poppet is initially opened and air pressure from either port A or port B is flowing through the solenoid valve assembly to chamber C, then an equalizing force is created to balance pneumatic forces on the piston poppet. The spring load will move the piston poppet to the closed position. If the air pressure at port A is higher, and additional closing force is created to act on the poppet area minus the poppet seating area.

If the piston poppet is initially closed by spring load and the higher air pressure is at port B, then an additional force is created to act upon the poppet seating area to hold the valve closed. When the solenoid valve assembly is energized, the actuator supply pressure is blocked. Chamber C is allowed to vent through the solenoid valve assembly.

If air pressure at port A is higher, then air pressure acting on the poppet seating area creates a force to open the piston poppet. If air pressure at port B is higher, then air pressure acting on the piston poppet area minus the poppet seating area creates a force to open the piston poppet. Once the piston poppet is opened, duct pressure acting on the poppet area holds the piston poppet open. The piston indicator switch assembly will close an electrical circuit when the piston poppet starts to open.

8. Bucket Modulation Control and Indication

A. General

Modulation of the buckets is automatic and is a function of mach number. The range of modulation is from 0 deg. to 21 deg. The nozzle angle scheduling units (NASU's) process the mach number signal to provide a command signal for the bucket control units. A NASU test switch is incorporated.

B. Location of Units (Ref. Fig. 011)

On panel 1-214 at the third crew member's (3 CM) station are the yellow NOZZLE caption light, the programme

AMBIENT VENT

SOLENOID VALVE ASSEMBLY SHOWN DE-ENERGIZED

A
B
SOLENOID VALVE ASSEMBLY WIRING DIAGRAM

B
NO
C
C
NC
A
POSITION INDICATOR SWITCH ASSEMBLY WIRING DIAGRAM

PISTON POPPED
SPRING
SHUTTLE VALVE
PORT A
AIR IN
AIR IN
PORT B
BODY
CHAMBER C
POSITION INDICATOR SWITCH ASSEMBLY

CMS 78 30 00 0 KAMO

Crossfeed Isolation Valve - Schematic Diagram
Figure 010

R

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selector switch engraved FLYOVER, NORMAL, APPROACH and the NASU test switch engraved 1, NORM, 2. The NASU's Nos. 1 and 2 are located in racking in zones 10-215 and 1-216 respectively. Bucket control units for engines 1 and 2 are also located in zone 10-215 and those for engines 3 and 4 are also located in zone 1-216 similarly.

C. Operation (Ref. Fig. 011 and 012)

Each air data computer supplies a mach number signal to the associated NASU. These provide a bucket command signal determining bucket position via NTRC (BCU). One NASU controls the two NTRC (BCU) for engines 1 and 4, and the other controls the units for engines 2 and 3. The bucket position varies between 21 deg at 0.55 M to 0 deg at Mach number greater than 1.1.

To improve the life of the pneumatic motor, an air shut-off valve closes when Mach number exceeds 1.2. To prevent buckets going into reverse inadvertently the ASOV is energized via the NTRC and/or the bucket position transmitter (indicator) 27° Sw. and reverse select relay. An air shut-off valve locking relay provides a latching facility for the supply valve. A bucket position transmitter (LVDT) supplies bucket modulated position for control and indication. The bucket position is displayed on a circular scale instrument on panel 1-214. Failures within either NASU cause automatic changeover resulting in all bucket control units being driven by the other NASU and illumination of the yellow NOZZLE caption light.

Each NASU has a magnetically latched fault annunciator which changes state to show a fault condition. The fault annunciator should be consulted if the NOZZLE caption comes ON without a switching error.

Should the third crew member omit switching to NORMAL after selection of FLYOVER above M 1.0, the yellow NOZZLE caption light will illuminate since E schedule operation (NORMAL) and selector position differ. (Ref. 77-13-00). Movement of the selector switch back to NORMAL will cause the light to be extinguished.

The test switch supplies 28 V d.c. to either NASU producing a fault signal which causes the NASU Mach, engine and ASOV signals to be transferred to the other NASU and illuminate the NOZZLE caption.

A dimming module, operated by a signal from the light test system (Ref. 33-14-00), is incorporated in the

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NORMAL
FLYOVER (F/O)
APPROACH (MID)
PROGRAMME SELECTOR SWITCH
HI
AUTO
LO
SECONDARY AIR DOORS
OPEN
AUTO
SHUT
OPEN
AUTO
SHUT
SECONDARY NOZZLE
BUCKET MODULATED POSITION INDICATORS
DEG 0 10 20 30
FLIGHT REV ARM
OPEN
NOZZLE
NASU TEST
1
NORM
2
CONTROL FAILURE CAPTION LIGHT
NASU TEST SWITCH
0 10 20 30
P3 AIR
BPDA
NTRC
NASU
NOZZLE ANGLE SCHEDULING UNIT
Z ORDER SIGNAL
NOZZLE AND THRUST REVERSER CONTROLLER
SIGNAL TREATMENT
REVERSE SELECT RELAY
ANGLE Z FEED - BACK SIGNAL
AIR SHUT-OFF VALVE
SLAVE AIR SUPPLY
LVDT POSITION DETECTOR
BUCKET BALLSCREW GEARBOXES AND BUCKETS (ANGLE Z)
BUCKET POSITION TRANSMITTER

CMB 78 30 00 0 AWMO 00

Bucket Modulated Position Indication
Location of Components and Schematic Diagram
Figure 011

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CMS 78 30 00 0 MAMO

Bucket Actuation System - Schematic Diagram
Figure 012

R

caption light.

Power supplies for equipment in the bucket modulation control system are detailed in Table 1.

	SERVICE	BUSBAR	PANEL
R	NASU 1 PROG CONT	2P	15-216
R	NASU 2 PROG CONT	1P	15-215
R	NASU TEST SUP	1P	15-215
R	ENG 1 BUCKET CONT UNIT SUP	1X	14-215
R	ENG 2 BUCKET CONT UNIT SUP	2X	13-215
R	ENG 3 BUCKET CONT UNIT SUP	3X	13-216
R	ENG 4 BUCKET CONT UNIT SUP	4X	14-216
R	NASU 1 SUP	4X	14-216
R	NASU 2 SUP	2X	13-215

Electrical Power Supplies
Table 1

9. Thrust Reverse Control

A. General (Ref. Fig. 013)

A reverse thrust lever operates four microswitches in a reverse thrust switch pack, one assembly per engine.
R Two of these microswitches signal the buckets to reverse
R position via the NTRC (BCU) and undercarriage weight
R relays. A reverse select relay which is energized prevents
R the air shut-off valve (ASOV) closing allowing the buckets
R to rotate.

R For the in-flight thrust reverse control mode the P3 air
R supply to the inboard engine bucket pneumatic motors is
R enhanced by outboard engines via one crossfeed isolation
R valve in each nacelle. The outboard engines are run at a
R slightly increased power setting during this operation. The isolation valves are electrically controlled by a single, magnetically latched FLIGHT REV ARM switch. A blue caption displays the legend OPEN when at least one of the

SWITCH SW11
CLOSED IN THIS AREA

SWITCHES
SW 10 AND SW 11
OPEN

FORWARD
MAXIMUM THRUST
(ZERO DEGREE
REFERENCE)

0°

- 41°.4

FORWARD IDLE
(0-43°8)

MAXIMUM REVERSE
(EMERGENCY USE)

NORMAL REVERSE

SWITCH SW4

REV BAULK

SWITCHES SW2-SW3

FWD BAULK

SWITCH SW1

REVERSE "OFF"

1 2 3 4 5 6 7 8

CLOSED

SW4
SW3
SW2
SW1

1 2 3 4 5 6 7 8

CMS 78 30 00 0 NAMO

Thrust Reverse Control and Throttle
Lever Action and Switch Packs
Figure 013

valves has started to open.

B. Location of Units (Ref. Fig. 014)

The reverse thrust switch packs are located in the centre
console throttle assembly under panel 9-211. The bucket
control and ASOV solenoids together with the bucket posi-
R tion transmitter (LVDT) are located in the pneumatic motor
R unit in the zones 417, 427, 437 and 447. ASOV locking relay
R is located in relay box 11-123 in the underfloor racking.

R The FLIGHT REV ARM switch and the blue OPEN caption
R are mounted on panel 1-214 at the 3 CM station. The
crossfeed isolation valves are mounted in the zones 417-
427, and 437-447.

C. Operation (Ref. Fig.015 and 016)
(Ref. Fig.017 and 018)

R Consists of two distinct phases : ground operation and in
R flight operation.

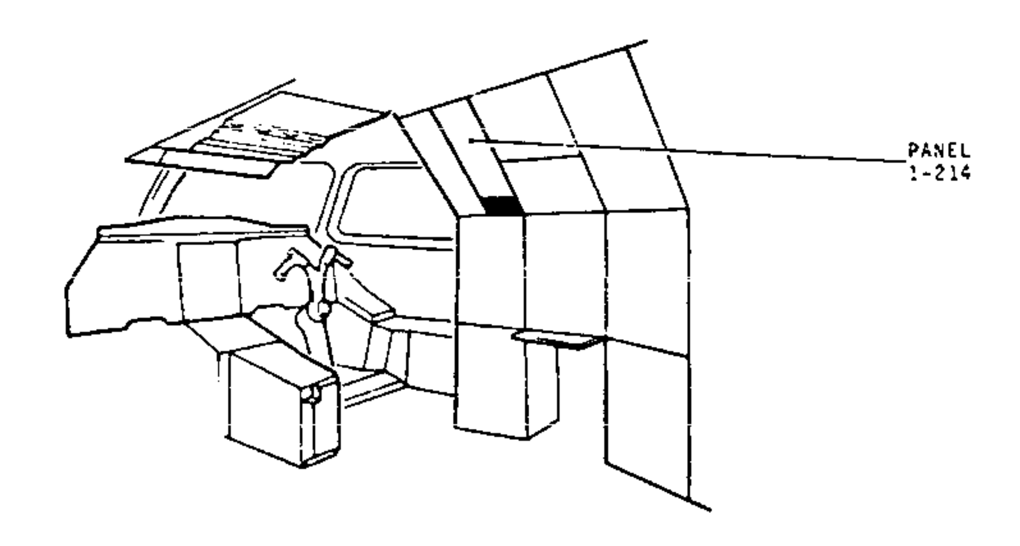
R Ground Operation
Moving the reverse thrust lever from the "reverse off"
position energizes the reverse select relay by closing
microswitch 1 in the reverse thrust switch pack (Ref. 77-
13-00). Further movement of the lever closes microswitches
2 and 3 in the pack and initiates closing of the buckets by
R energizing the reverse relay inside the NTRC (BCU).

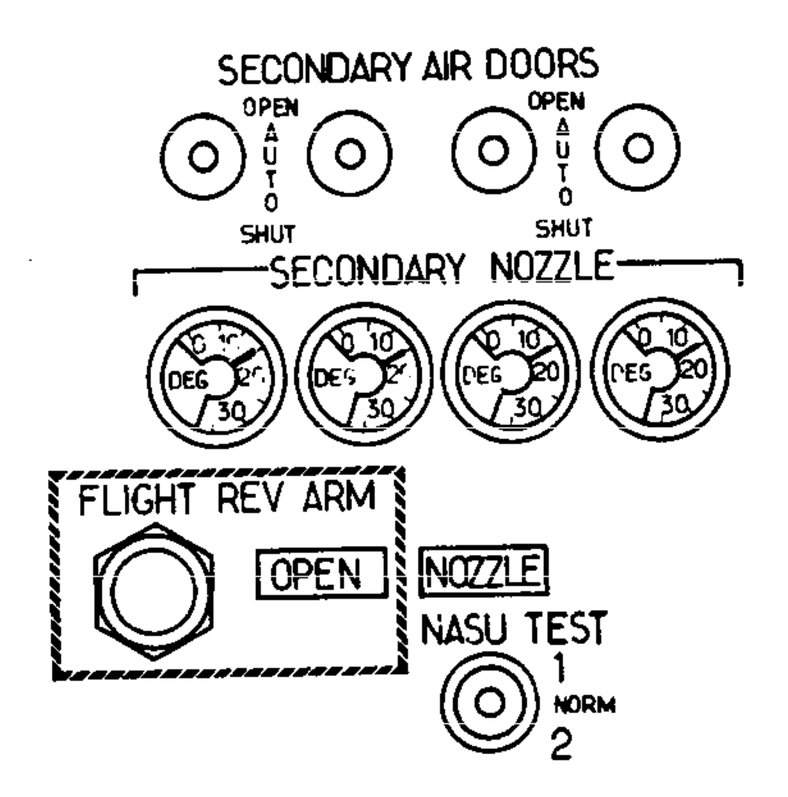
R The buckets are then driven to the fully closed position
by the pneumatic motor.

When the buckets reach the 71 deg. - 73 deg. position, a
R microswitch operated by the buckets signals the reverse
baulk to withdraw and allows full reverse power to be
R applied and energizes the 71 deg relay to select engine
R operating schedule.

Returning the lever towards "reverse off" opens micro-
switches 3 and 2 in the reverse thrust switch pack and
initiates opening of the buckets. When the buckets reach
the forward thrust position, a microswitch operated by
the buckets signals the forward baulk to withdraw and
allows the reverse thrust lever to go to idle, opening
microswitch 1 in the pack to de-energize the system.

R In Flight Operation
R For the flight mode, depressing the magnetically latched
R FLIGHT REV ARM switch energizes the two cross bleed isola-
R tion valve solenoids thus opening the valves. The switch





CMS 78 30 00 0 PAN0

FLIGHT REV ARM Switch Location
Figure 014

R

R Reverse Thrust Control
Figure 015

MAIN
K 1101
28 Vdc
WIND-DOWN
CONTROL RELAY
E 127
A 53
A 52
WIND-DOWN
A 55
A B
K 1102
28 Vdc
BUCKET POSITION TRANSMITTER
K 1108
A 53
A 52
SW 1
28 Vdc
45-73°
A 55
SW 5
REV. THRUST LEVER
SWITCH PACK
K 332
0-71°
SW 4
FWD
A B
ALTERNATE
REV (Above Idle)
SW 11
> -41°4 (INCREASING POWER)
< -41°4 (DECREASING POWER)
FWD THRUST LEVER SWITCH
PACK K1548
A
E 124
FWD BAULK
A.S.O.V.
REVERSE SELECT
RELAY E 463
E 128
WIND
DOWN AND
ASOV TEST
SWITCH
E
A.S.O.V.
0-27°
E 121
28 VDC
REV. BAULK
D
SW 3
B
SW 2
C
A
E 123
71°-73°
REV
E 466
FLASHER
UNIT
E 122
POWER PLANT MANAGEMENT
LIGHTS - SEE FIGURE 2
U/C WEIGHT RELAYS

R

Reverse Thrust and Wind-Down Control
Figure 016

CMS 78 30 00 0 SAMO

4P
28 V
DC
BUSBAR
SW2
SW3
FWD
REV.
C3
C2
C1
G310
A3
A2
A1
G306
CANCEL
IN FLIGHT
REVERSE
ARM SWITCH
SET
NTRC
(BCU)
BUCKET PNEUMATIC
DRIVE ACTUATORS
(BPDA)
3P
A3
A2
A1
G304
D3
D2
D1
G318
BUCKET
POSITION
71° RELAYS
TO ECU ENG 2
REVERSE
SELECT
RELAYS
3P
C3
C2
C1
G300
C3
C2
C1
G315
BUCKET
POSITION
71° RELAYS
TO ECU ENG 3
4P
C3
C2
C1
G314
D3
D2
D1
G309
REVERSE
LEVER
SWITCHES
U/C WEIGHT
SWITCH
RELAYS
REVERSE
SELECT
RELAYS

Reverse Thrust Inhibit
Figure 017

R

CROSSFEED ISOLATION VALVE

CANCEL

SLT

REVERSE LEVER SWITCHES

FWD

SW 3 (ENG. 2) REV

"PROPPED IDLE" ORDER

NTRC 2

MAIN (ENGINE 1)

ALTERNATE (ENGINE 1)

SHUT

UNDERCARRIAGE WEIGHT RELAYS

"Aj Max" order

OPEN

B OPEN B

MAIN (ENGINE 2)

2E461

SW1 REV

ALTERNATE (ENGINE 2)

MAIN (ENGINE 3)

3E461

SW1

ALTERNATE (ENGINE 3)

SHUT

OPEN

NTRC 3

MAIN (ENGINE 4)

SW3 (ENG. 3)

ALTERNATE (ENGINE 4)

UNDERCARRIAGE WEIGHT RELAYS

CROSSFEED ISOLATION VALVE

ENGINE CONTROL UNITS

THROTTLE LEVER 10% RELAYS

IN FLIGHT REVERSE ARM SWITCH

REVERSE SELECT RELAYS

BUCKET POSITION 71° RELAYS

Reverse Thrust in Flight
Figure 018

R

will latch in when all four forward throttle lever 10 % relays are de-energized, i.e. when the throttle levers are below the 10 % position. When at least one of the isolation valves has started to open, a valve-operated contact provides an earth return to the (blue) OPEN caption which illuminates.

The latched switch, when depressed, also supplies a 28 V d.c. signal to engines No. 1 and 4 throttle control main and alternate amplifiers via the energized reverse select relays and the de-energized bucket position 71 deg. relays. The purpose of this signal is to activate the propped idle circuits of engines 1 and 4 and to adjust the primary nozzles when inboard reverse thrust is selected as described in the foregoing paragraphs.

When the 71 deg. relays are energized the 28 V d.c. signal to engine No.1 and 4 engine control units is cancelled. In forward thrust, when bucket position is greater than 27 deg the ASOV is signalled to close by the NTRC (BCU) and/or the bucket position transmitter (indicator) 27° switch and by contacts of the de-energized reverse select relay, and is latched closed by the ASOV locking relay. The buckets are free to take up their aerodynamic position.

The bucket position transmitter (LVDT) is a linear variable differential transformer in the pneumatic motor unit and supplies a "position of buckets" signal to the bucket modulated position system for control (feedback), indication, and ASOV control.

Provision is made for checking the ASOV system by means of the wind down and ASOV test switch.

Power supplies for equipment in the thrust reverse control system are detailed in Table 2.

SERVICE	BUSBAR	PANEL
ENG 1 REV THRUST ASOV CONT	4P	3-213
ENG 2 REV THRUST ASOV CONT	3P	1-213
ENG 3 REV THRUST ASOV CONT	3P	1-213
ENG 4 REV THRUST	4P	3-213

SERVICE	BUSBAR	PANEL
R ASOV CONT		
R ENG 2 PP MGT LTS SUP/REV THRUST R X BLEED SUP	3P	1-213
R ENG 3 PP MGT LTS SUP/REV THRUST R X BLEED SUP	3P	1-213

Electrical Power Supplies
Table 2

10. Thrust Reverse Bucket Position Indication

A. General

R Bucket position indication for each engine is displayed by a caption light engraved REV. The bucket position transmitter (Indicator) switch pack controls:

(1) Signals to the flasher unit and determines the indication.

(2) The energizing of the reverse baulk solenoid via an undercarriage weight switch relay.

(3) The energizing of the forward baulk solenoid via the reverse select relay.

R (4) The energizing of the ASOV via the reverse select
R relay.

R (5) A signal to the main and alternate engine control amplifiers for control of AJ min. (Ref. 76-11-00).

R (6) The energizing of the AJ min. time delay relay (Ref. 77-13-00).

R (7) The energizing of the bucket position 71 deg. relay.

The wind down test switch also checks the bucket position indication circuits.

B. Location of Units (Ref. Fig. 019)

The bucket position indication caption light is mounted on

CAPTION LIGHTS (4 OFF)

CMS 78 30 00 0 UAM0

R

Thrust Reverse Bucket Indication
Figure 019

the centre dash panel 6-211; the flasher unit, wind down control relay and blocking diodes are located in the under-floor equipment bay racking 5-123,11-123 and 19-123 respectively. The forward and reverse baulk solenoids are located in the throttle assembly, centre console.

C. Operation (Ref. Fig. 020)

With the thrust reverse buckets in the forward thrust position, one of the switches in the bucket position transmitter (indicator) switch pack is made and provides a supply:

(1) For the forward baulk solenoid via the contacts of the reverse select relay. (This relay energizes only when reverse thrust is selected).

(2) To energize the wind down control relay.

(3) To the flasher unit to inhibit its output to the REV caption which is then not illuminated.

On selection of reverse thrust and when the buckets move outside the bucket modulation region (0 deg. to 27 deg.), the switch in the bucket position transmitter (indicator) switch pack opens, breaking the supply to the forward baulk solenoid and the flasher unit. This unit then operates as a free-running multivibrator and provides a pulsed supply to the REV caption which flashes. The wind down control relay de-energizes on breaking of the contacts of the reverse select relay.

When the buckets are in the reverse thrust position (71 deg. to 73 deg.) a switch in the bucket position trans-
R mitter (indicator),switch pack closes and provides a supply to the reverse baulk solenoid with the aircraft on the ground; the under-carriage weight switch relay prevents increase of engine power above idle when in flight with reverse thrust selected. This second switch also provides a second supply to the flasher unit which now produces a continuous output to the REV caption which is then continuously illuminated.

The wind down test switch simulates the action of these switches in the bucket position transmitter (indicator) switch pack to check out the indication circuits.

A dimming facility is incorporated in the REV caption light.

Power supplies for equipment in the thrust reverse bucket

ENGINE CONTROL AMPLIFIER (ALTERNATE) (REF. 76-11-00)

WIND DOWN CONTROL RELAY

POWER PLANT MANAGEMENT LIGHTS (REF. 77-13-00)

POWER PLANT MANAGEMENT LIGHTS (REF. 77-13-00)

ENGINE POWER WIND DOWN (REF. 76-11-00)

ENGINE POWER WIND DOWN (REF. 76-11-00)

ENGINE CONTROL AMPLIFIER (MAIN) (REP. 76-11-00)

AJ MIN. TIME DELAY RELAY (REF. 77-13-00)

SW1 IN REVERSE THRUST SWITCH PACK (REF.77-13-00)

FORWARD BAULK SOLENOID

TD

BLOCKING DIODE

BUCKET POSITION 71° RELAY

REVERSE SELECT RELAY

WIND DOWN AND AIR SHUT-OFF VALVE TEST SWITCH (REF. 76-11-00)

BLOCKING DIODE

0-27°

71°-73°

REVERSE BAULK SOLENOID

UNDERCARRIAGE WEIGHT SWITCH SERVICES (REF. 32-61-00)

LANDING GEAR WEIGHT SWITCH RELAY

BUCKET POSITION SWITCH PACK

OFF
A
B
C

ENGINE POWER WIND DOWN 76-11-00

WIND DOWN TEST SWITCH (REF. 76-11-00)

CMS 78 30 00 0 VAMO

BUCKET POSITION INDICATOR

B | REV | B

D

POWER PLANT MANAGEMENT LIGHTS (REF. 77-13-00)

ESSENTAL DC BUSBAR

FLASHER UNIT

NOTES : 1. 'D' DENOTES DIMMING FACILITY
2. 'TD' DENOTES TIME DELAY
3. DIAGRAM IS FOR ONE ENGINE. ALL ENGINES ARE SIMILAR

Thrust Reverse Bucket Position Indicator
Figure 020

R

position indication system are detailed in Table 3.

SERVICE	BUSBAR	PANEL
ENG 1 REV BUCKET POSN IND	4P	5-213
ENG 2 REV BUCKET POSN IND	3P	1-213
ENG 3 REV BUCKET POSN IND	3P	1-213
ENG 4 REV BUCKET POSN IND	4P	5-213

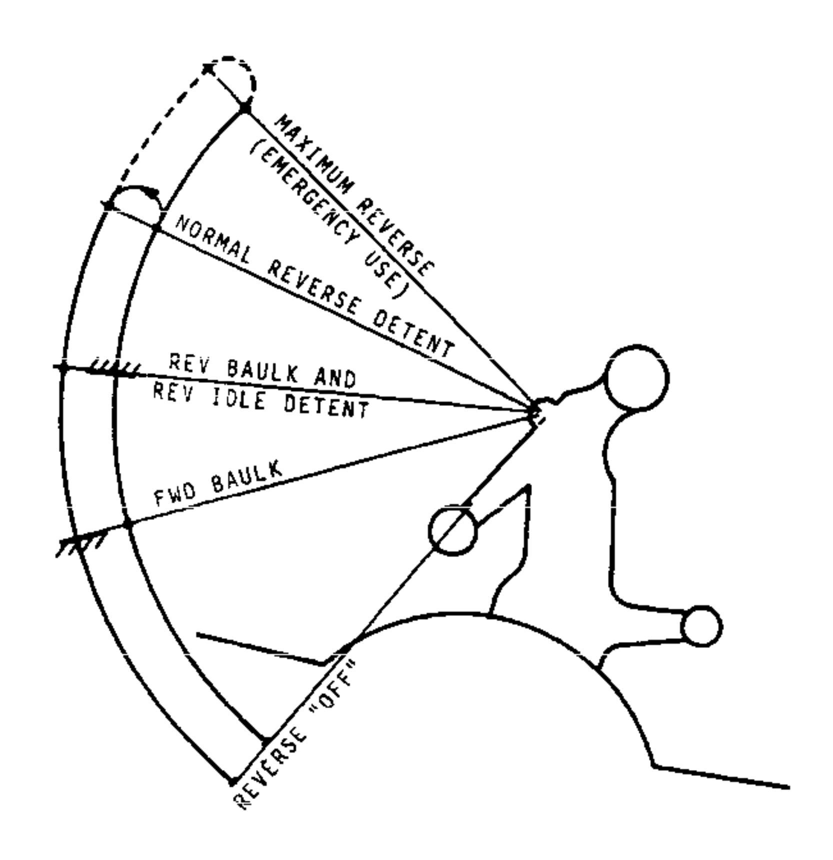
Electrical Power Supplies
Table 3

R 11. Reverse Thrust Lever Detent Positions.

R A. Operation (Ref. Fig. 021)

R When the aircraft is on the ground and the buckets have reached the reverse position, the baulk is electrically removed and reverse thrust in excess of reverse idle may be selected. Normally this is limited by a detent to an engine power setting corresponding to approximately 88%. In an emergency the reverse thrust lever can be moved beyond the detent to a maximum position corresponding with a reverse thrust power of approximately 90% by exerting a force of approximately 9 lbf on the lever.

R A second detent is provided at the reverse idle position. This is to facilitate the location of reverse idle on return from a higher reverse thrust position when the immediate selection of forward thrust is not required.



CMS 78 30 00 0 WAMO

Thrust Reverse Lever Positions
Figure 021

R

THRUST REVERSER - REMOVAL/INSTALLATION

WARNING: COMPLY WITH THE ELECTRICAL SAFETY PRECAUTIONS IN 24-00-00.

1. General

This topic contains general instructions for the removal/installation of minor electrical components fitted to panels and equipment racks that are common to Chapter 78-30-00.

R The panels and equipment racks and their associated minor
R electrical equipment are as follows:

R Power management panel 1-214: Test switch and caption light.
R Underfloor equipment bay racking 5-123: Flasher units.
R Underfloor equipment bay racking 11-123: Relays and bases for
R air shut-off valve locking. Underfloor equipment bay racking
R 19-123: Relays, bases and diodes for wind-down control, AJMIN
R FAIL and BKT POSN 71°.
R Underfloor equipment bay racking 20-123: Relays, bases and
R diodes for wind-down control, AJMIN FAIL and BKT POSN 71°.

R A. Panel (Ref. Fig. 401)

R Switches are mounted from the rear of the panel, the components being accessible with the panel lowered on its hinges. The caption is mounted from the front and clamped to the panel at the rear. Cable formers, which act as panel strengthening supports at the rear of the panel, support cable looms and terminal blocks which may restrict access to some components, terminals or connectors. These cable looms and terminal blocks may be temporarily moved to improve access to electrical components.

Electrical connections to the test switch and caption light modules are made to socket type terminals; the rotary switch has flyleads.

R B. Underfloor Racking (Ref. Fig. 402, 403 and 404)

The relay boxes and diodes are mounted in the forward underfloor racking in zone 123. Sufficient cable is provided to allow each box to be withdrawn from the
R racking, for individual component removal, without electrically disconnecting the box from the aircraft wiring, thus subsequent test procedures require a test of only the associated circuit or component. Components within the boxes are mounted on one side of

a vertical chassis with the associated wiring assembled on the reverse side.

Relay boxes 11-123, 19-123 and 20-123 do not have a side cover and direct access to components is possible. The diodes in each relay box are mounted on an insulation board, secured to the chassis by distance pillars and protected by a diode cover. Relays are of the plug-in type, each being secured to its base by nuts and washers, or by a spring clamp. Diodes have terminal tags crimped to wire ends which are connected to mounting studs with securing nuts and washers.

CAUTION: WHEN INSTALLING ELECTRICAL COMPONENTS THE TORQUE LOADING OF TERMINAL SECURING DEVICES FOR CERTAIN COMPONENTS MUST BE CARRIED OUT IN ACCORDANCE WITH 20-27-14.

ELECTROLUMINESCENT (EL) PANELS ARE SUSCEPTIBLE TO SCRATCHES AND CRACKS. ENSURE THAT TOOLS DO NOT DAMAGE THE POLISHED WALLS OF THE PANELS.

2. Electrical Components Mounted on Panel 1-214

A. Equipment and Materials

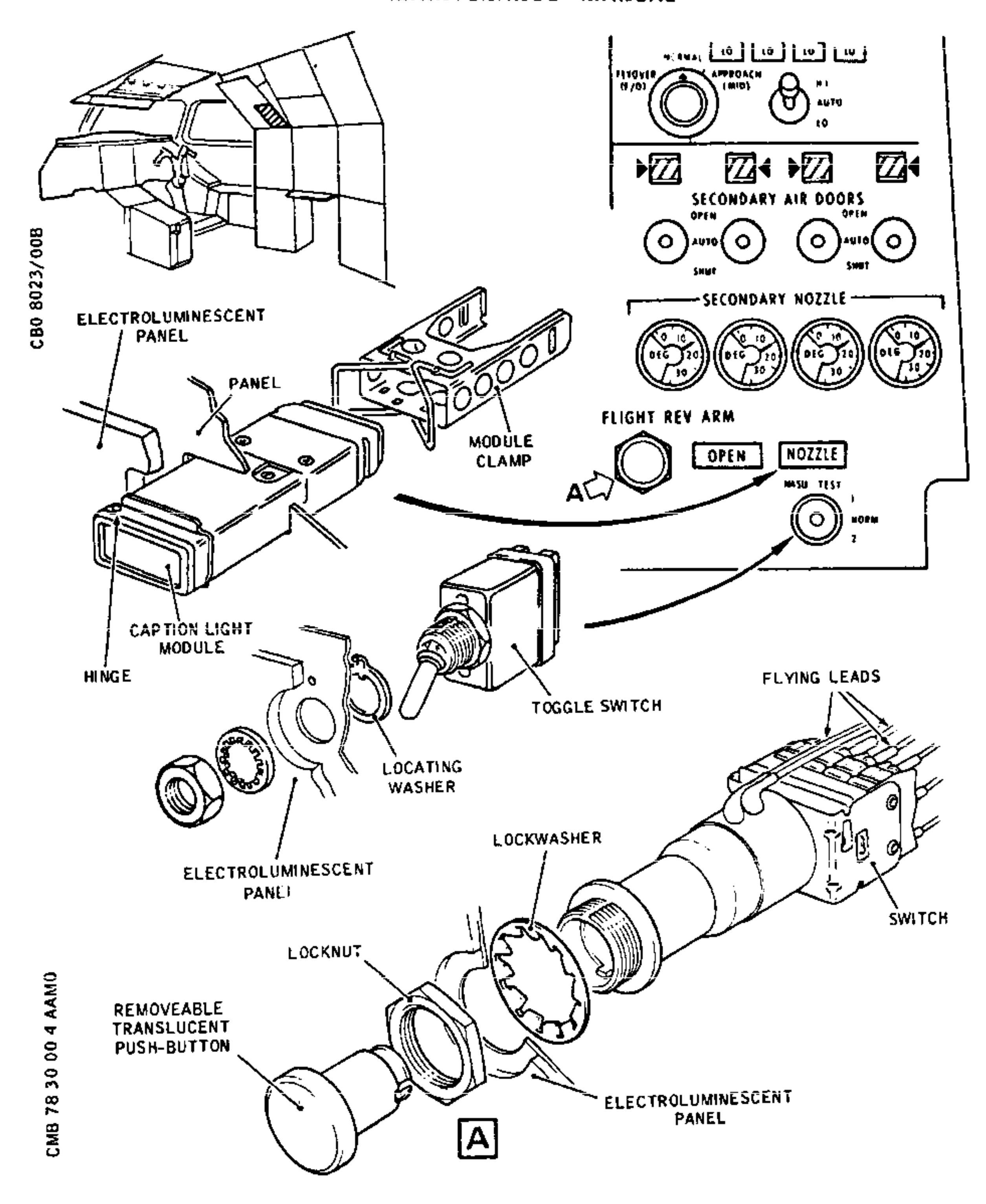
DESCRIPTION	PART NO.
Extraction tool, caption light module spring clamp	-
R Torq-set screwdriver	MS33781

B. Prepare (Ref. Fig. 401)

NOTE: On electrical components with socket type terminals the pin inserts must be disconnected and connected
R in accordance with the Wiring Diagram Manual, 20-42-18.

(1) Isolate the electrical generation and external power in accordance with 24-00-00, Servicing.

(2) Loosen the screws and withdraw the electrolumine-
R scent panel (Ref.33-16-00 Removal/Installation)
R sufficiently to gain access to the securing screws.



R Minor Electrical Components - Panel 1-214
Figure 401

(3) Loosen the quick-release fasteners securing the panel, press in the spring retaining clip and lower the panel on its hinges to the extent of the check cords.

C. Remove Toggle Switch

(1) Withdraw the pin inserts from the rear of the switch in accordance with Wiring Diagram Manual, 20-42-18.

(2) Using a tubular spanner, remove the nut and washer from the front of the panel; withdraw the switch and tabwasher from the panel rear.

D. Install Toggle (Test) Switch

(1) Comply with the electrical safety precautions.

(2) Position the tabwasher on the switch and insert the switch through the opening from the panel rear; ensure that the lug on the tabwasher engages the locating hole in the panel.

(3) Secure the switch with the nut and washer.

(4) Connect the electrical cables to the switch, ensuring that the connections are made in accordance with the cable identifications and the applicable wiring diagram. Connect pin inserts in accordance with
R Wiring Diagram Manual, 20-42-18.

E. Remove Caption Light Module

(1) If necessary, release the cable loom ties for access to the terminals at the rear of the caption light module.

(2) Withdraw pin inserts from the rear of the module in
R accordance with Wiring Diagram Manual, 20-42-18.

R (3) Using the extraction tool, disengage the clamp retaining springs at the rear of the module and remove the module from the front of the panel and the clamp from the rear.

F. Install Caption Light Module

(1) Comply with the electrical safety precautions.

(2) Position the clamp on the rear of the panel and

insert the caption light module through the hole from the front. Ensure that the white-painted line on the back of the panel and the hinged edge of the module are in alignment, and that the clamp is aligned symmetrically with the module.

(3) Hold the module firmly against the panel front and simultaneously press the clamp into position from the rear, until the retaining spring engages with the recesses in the module body.

(4) Connect the electrical cables to the module, ensuring that the connections are made in accordance with the cable identifications and the applicable wiring diagram. Connect pin inserts to the module in accordance with Wiring Diagram Manual, 20-42-18.

(5) Secure the cable loom ties, as necessary in accordance with 20-27-15.

G. Remove Push Switch

(1) Disconnect the switch flying leads.

(2) Pull off the translucent push button.

(3) Using a tubular spanner, remove the hexagon nut from the front of the panel and withdraw the switch and lockwasher from the rear.

H. Install Push Switch

(1) Comply with the electrical safety precautions.

(2) Insert the switch with lockwasher from the rear of the panel with the longitudinal groove in the thread uppermost; secure the switch in position with the hexagon nut.

(3) Push on the translucent push button so that the keying tab fully engages the groove in the protruding part of the body thread.

(4) Connect the flying leads to the switch ensuring that the connections are made in accordance with the cable identifications and the applicable wiring diagram.

J. Conclusion

(1) Check that the area is clean, close the panel and secure it with the quick-release fasteners.

(2) Secure the electroluminescent (EL) panel
R (Ref.33-16-00, Removal/Installation).

(3) Make available electrical ground power Ref.24-41-00.

(4) Carry out a static test of the Thrust Reverser system (Ref.78-00-00).

3. Electrical Components Mounted in Racking 5-123, 11-123, 19-123, 20-123

A. Equipment and Materials

DESCRIPTION	PART NO.
Torq-set screwdriver	MS 33781
Torque spanner range 0 - 0.5 lbf in. (0 - 0.056 mdaN) R	-

B. Prepare (Ref. Fig. 402, 403 and 404)

(1) Isolate the electrical generation and external power in accordance with 24-00-00, Servicing.

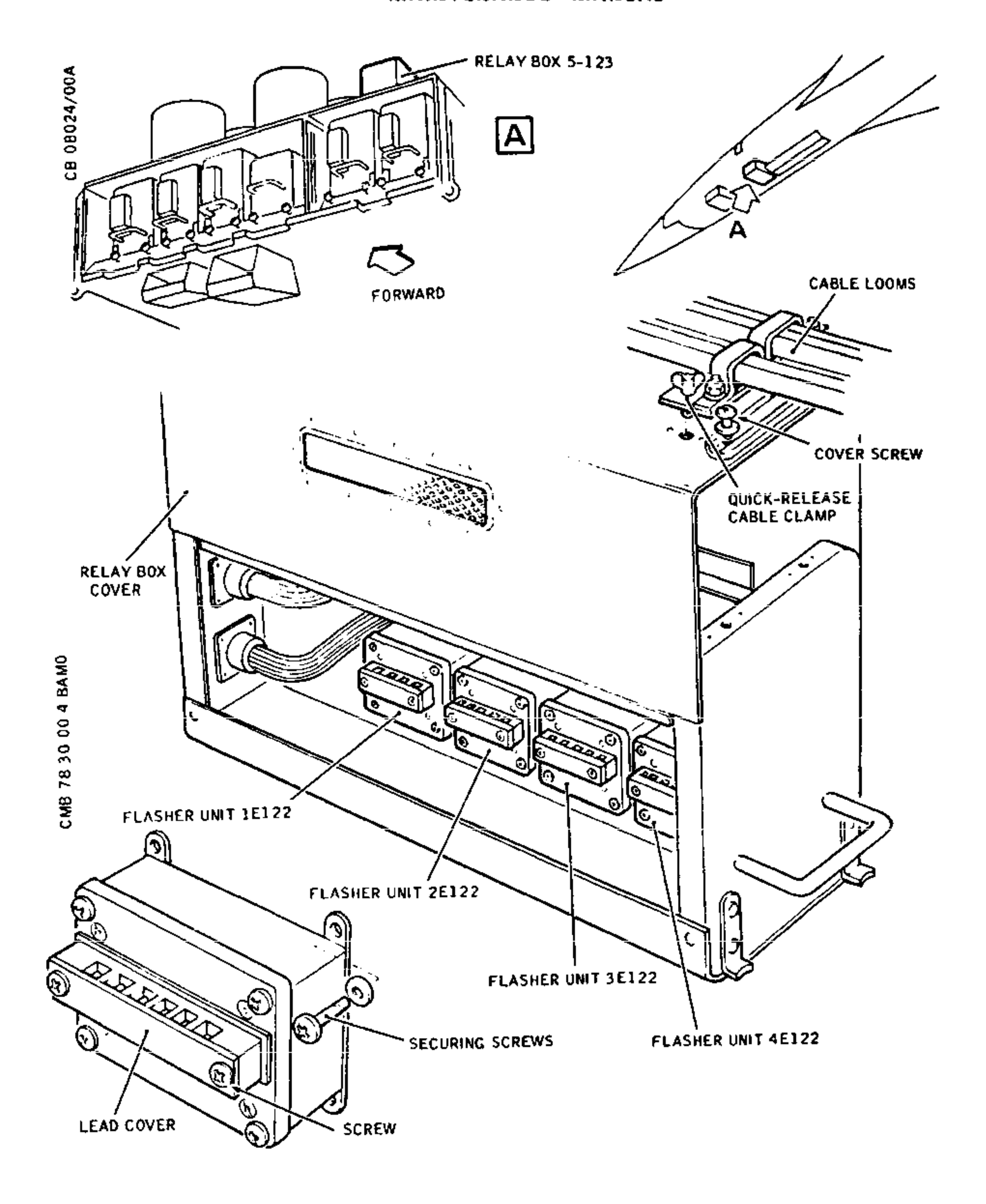
(2) Open the service compartment door 123 BB (Ref. 54-41-11) to gain access to LH and RH engine relay boxes 19-123, 20-123 or to miscellaneous relay boxes 5-123 and 11-123.

(3) Release the hold-down fasteners from the approp-
R riate engine or miscellaneous relay box hold-down hooks.

(4) Withdraw the panel from the rack sufficiently to gain access to the quick-release cable clamps on top of the box.

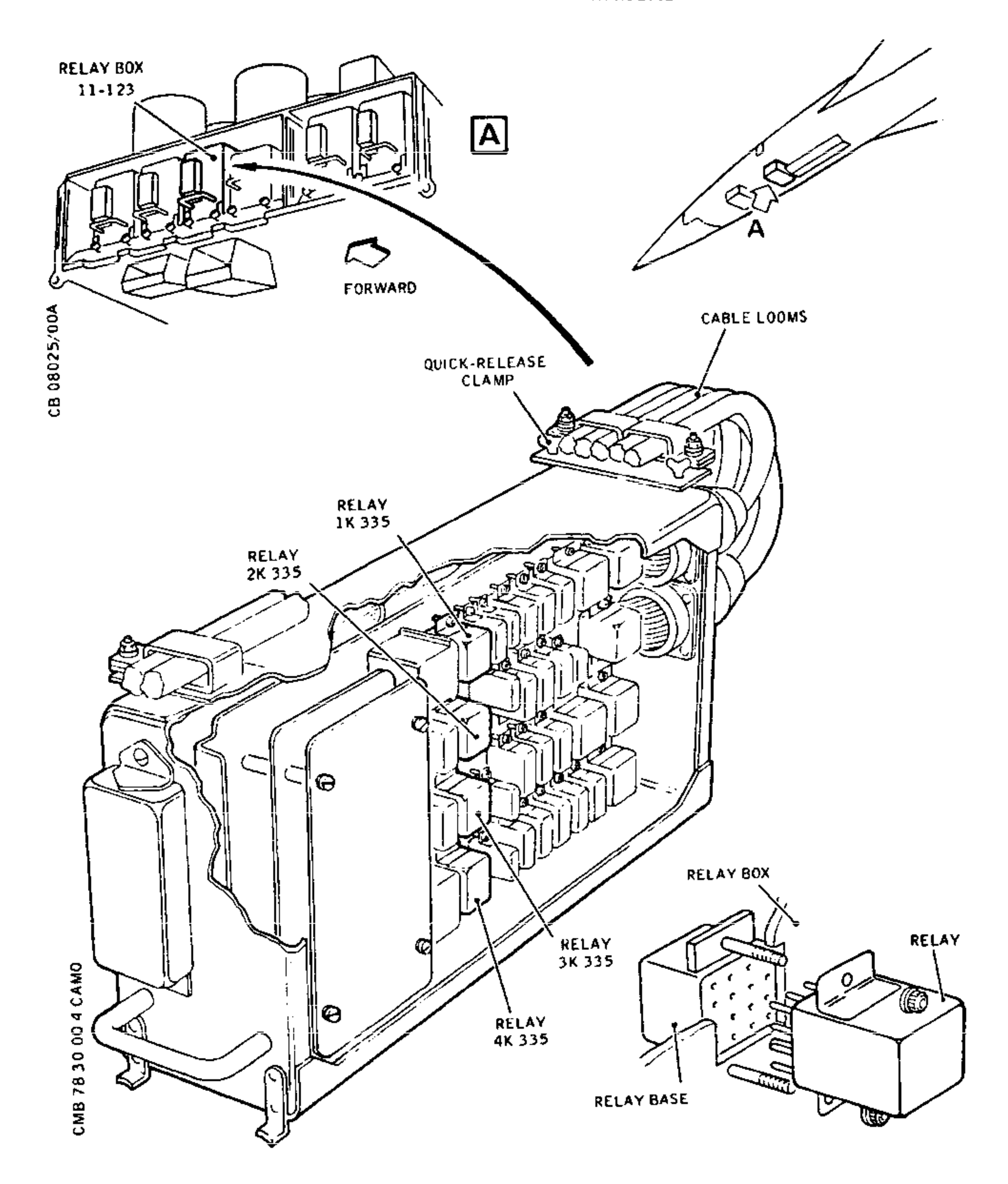
(5) Release the cable clamps to detach the cables from the top of the box.

(6) Move the box clear of the rack and lower it onto a suitable support.



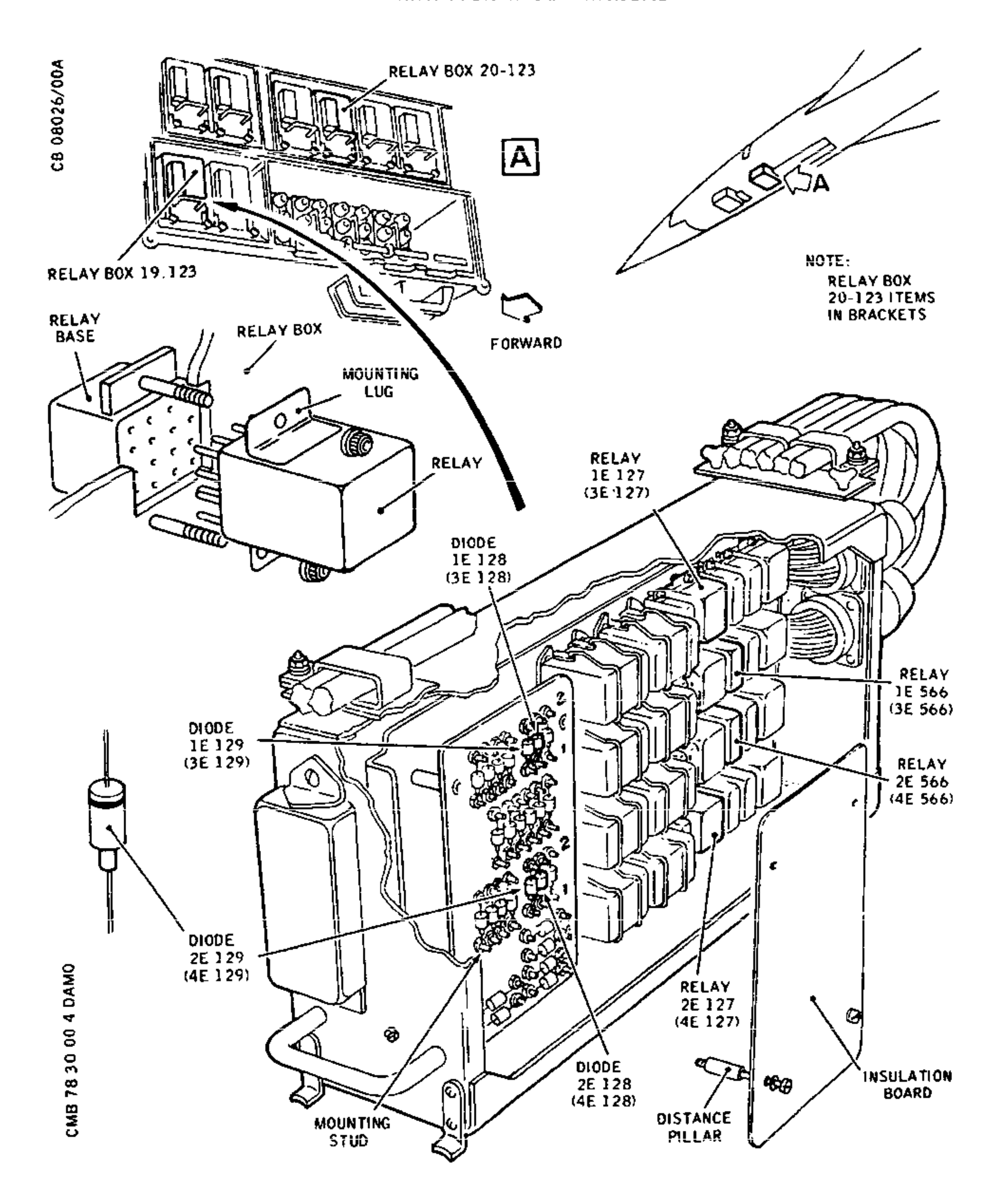
Minor Electrical Components - Relay Box 5-123
Figure 402

R



Minor Electrical Components - Relay Box 11-123
Figure 403

R



Minor Electrical Components - Relay Box
19-213 and 20-123
Figure 404

R

C. Remove Flasher Unit (Ref. Fig. 402)

1) Remove the screws and washers securing the top cover of relay box 5-123.

(2) Remove the screws and cover over the terminals of the appropriate flasher unit.

(3) Remove the screws securing the leads to the flasher unit and disconnect the leads; replace the screws and the terminal cover and screws.

(4) Remove the screws and washers securing the flasher unit to the box; remove the flasher unit.

D. Install Flasher Unit (Ref. Fig. 402)

(1) Comply with the electrical safety precautions.

(2) On relay box 5-123 engage the flasher unit with the relay box and secure it in position with screws and washers.

(3) Torque-tighten the screws using the Torq-set screwdriver.

(4) Secure the electrical cables to the flasher unit in accordance with the cable identification and the applicable wiring diagram. Secure the cables with the terminal screws and torque-tighten the screws.

(5) Replace the terminal cover strip and secure it with the screws. Torque-tighten the screws using the Torq-set screwdriver.

(6) Replace the top cover and secure it with screws and washers. Torque-tighten the screws using the Torq-set screwdriver.

E. Remove Relay (Ref. Fig.403 and 404)

R B NOTE: When removing/installing "Wind-down Control Relay and/
R B or the Air shut-off Valve Locking Relay" make an entry
R B in the Aircraft Technical Report (Sector Defect Log)
R B that a secondary nozzle ASOV check must be carried out
R B on departure from that station/base.

(1) Remove the nuts and washers of the spring clamp, as applicable, securing the relay to its mounting base and withdraw the relay from its socket.

F. Install Relay (Ref. Fig.403 and 404)

(1) Comply with the electrical safety precautions.

(2) Check that the relay pins are clean and undamaged.

(3) Align the locating pin on the relay body with the locating hole in the relay mounting base, then plug the relay into the socket.

(4) Secure the relay body to the mounting base with the nuts and washers, or the spring clamp, as applicable.

NOTE: After installing either Wind-Down Control Relay or Air Shut-Off Valve Locking Relay, perform Bucket Control System Wind-Down Test (Ref.78-00-00, Adjustment/Test).

G. Remove Diode (Ref. Fig. 403)

(1) Remove the screws securing the diode board cover to the distance pillars and remove the cover from the diode board.

(2) Disconnect the diode from the mounting studs and remove the diode from the board.

H. Install Diode (Ref. Fig. 403)

(1) Comply with the electrical safety precautions.

NOTE: If the replacement diode does not have tags fitted to wire ends, the terminal tags must be crimped to the ends in accordance with the Wiring Diagram Manual, 20-21-01. Tags for diodes are pin 1: Solid strand and AMP 34105, and Pin 2: Solid strand 34104-T006-02.

(2) Position the replacement diode so that the black ring on the cathode end is pointing to terminal 2 on the diode board. Secure the tags to the mounting studs with the nuts and washers. Torque-tighten the terminal nut to 0.5 lbf in (0.056 mdaN).

(3) Check that the area is clean and refit the diode board cover to the distance pillars. Secure the cover with the screws.

J. Conclusion

(1) Mount the relay box on the end of the rack support rails and secure the cables to the top of the panel with the quick-release cable clamps.

(2) Slide the box into the racking and secure it with
R the hold-down fasteners.

(3) Check that the relay box is bonded in accordance with 20-27-11.

(4) Cancel the electrical safety precautions and check the operation of the components by carrying out a
R test on the Thrust Reverser system (Ref.78-00-00, Adjustment/Test).

(5) Check that the area is clean and lock the service compartment door 123 BB (Ref.52-42-11).

THRUST REVERSER - ADJUSTMENT/TEST

1. General

The test procedure described in this chapter shall be carried out after installation of the thrust reverser system on the aircraft, or when a mechanical malfunction has been diagnosed during trouble shooting. The purpose of this test is to check the combined function of the drive components and associated mechanisms in the nacelle, and to make sure that the system drag torque is within acceptance limits.

WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE ON WHICH WORK IS GOING TO BE CARRIED OUT.

2. Measurement of the Bucket System Drag Torque

A. Equipment and Materials

DESCRIPTION	PART NO.
Extension	9970-515-296 R (HZAA1623)
Torque wrench "STOKVIS", type T.E.C. 3 FU, 0 to 0,3 daN.m range (0 to 26.5 lbf. in)	-
Circuit breaker safety clips	-
Pneumatic vibration screwdriver pre-adjusted at 0,60 daN.m, (53 lbf.in.) and the appropriate screwdriver head. Pneumatic impact wrench (unscrewing mode) (ARO 8530 PC 1) and the appropriate screwdriver head.	-

B. Preparation (Ref. Fig.501 and 502)

(1) Electrically isolate the engine and exhaust assembly services indicated in Table 501 by tripping the circuit breakers affecting engines in the nacelle upon which work is being carried out. Fit circuit breaker safety clips.

(2) Display a suitable placard on the engine starting panel indicating that personnel are working on the engines and in the twin secondary nozzle area.

(3) Check that the pneumatic drive actuator manual lock-out system is in the unlock position (Ref. 78-33-06. Adjustment/Test).

CAUTION: AN INCORRECT POSITION OF THE MANUAL LOCK MAY RESULT IN DAMAGE TO THE UNIT AS THE AIR MOTOR ROTORS ARE MECHANICALLY LOCKED.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINE No. 1			
BUCKET CONT UNIT SUP	14-215	1K1132	E12
REV THRUST CONT	3-213	1K331	D 1
PP MGT LTS SUP	5-213	1E461	D 1
WIND DOWN CONT SUP 1	5-213	1K1101	B 1
WIND DOWN CONT SUP 2	1-213	1K1108	C 7
PP MGT LTS SUP (crossfeed)	1-213	2E461	E 3
REV THRUST ASOV CONT	3-213	1K334	G 3
ENGINE No. 2			
BUCKET CONT UNIT SUP	13-215	2K1132	G14
R REV THRUST CONT	1-213	2K331	B 5
WIND DOWN CONT SUP 1	1-213	2K1101	F 4
WIND DOWN CONT SUP 2	5-213	2K1108	C 1
PP MGT LTS SUP (crossfeed)	1-213	2E461	E 3
REV THRUST ASOV CONT	1-213	2K334	D 7
ENGINE No. 3			
BUCKET CONT UNIT SUP	13-216	3K1132	C 6
R REV THRUST CONT	1-213	3K331	B 6
WIND DOWN CONT SUP 1	1-213	3K1101	F 5
WIND DOWN CONT SUP 2	5-213	3K1108	C 2
PP MGT LTS SUP (crossfeed)	1-213	3E461	E 4
REV THRUST ASOV CONT	1-213	3K334	D 8
ENGINE No. 4			
BUCKET CONT UNIT SUP	14-216	4K1132	C 6
REV THRUST CONT	3-213	4K331	D 2
PP MGT LTS SUP	5-213	4E461	D 2

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
WIND DOWN CONT SUP 1	5-213	4K1101	B 2
WIND DOWN CONT SUP 2	1-213	4K1108	C 8
PP MGT LTS SUP (crossfeed)	1-213	3E461	E 44
REV THRUST ASOV CONT	3-213	4K334	G 4

Circuit Breakers
Table 501

(4) Remove the access panel to the ballscrew gearbox No.2 (Ref. Fig. 501), using a pneumatic impact wrench equipped with an appropriate screwdriver head.

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.

USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO DETERIORATION OF THE SCREWS.

BEFORE CARRYING OUT ANY WORK, THE SECONDARY NOZZLE MUST BE LINED WITH RUBBER CARPETS TO AVOID DAMAGE RESULTING FROM ACCIDENTIAL BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES MUST ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

(5) Remove the access cover to the ballscrew gearbox driver (Ref. Fig. 502), (Detail A).

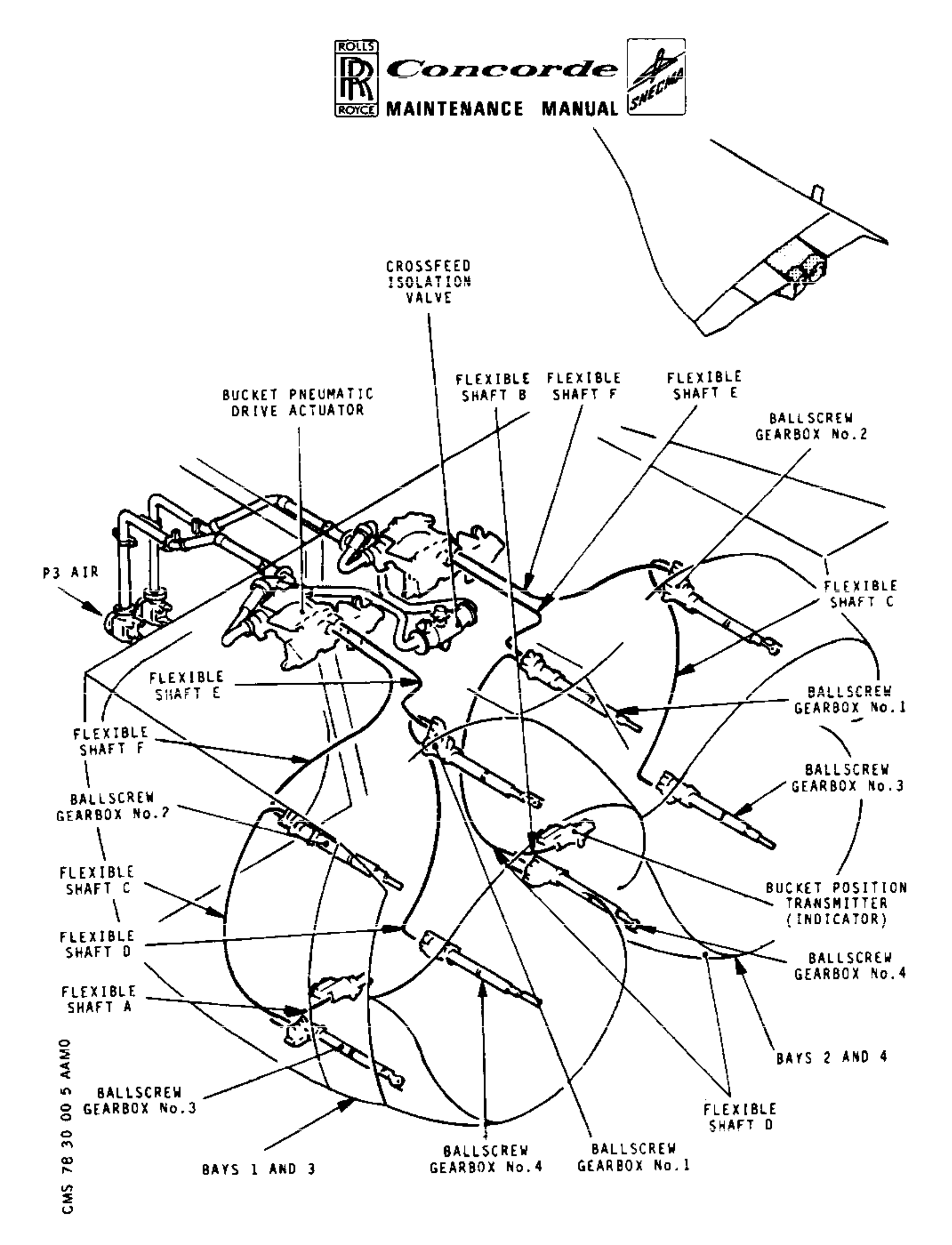
C. Measurement of the Bucket System Drag Torque

(1) Fit the extension to the torque wrench "STOKVIS".

(2) Position the hexagonal end of the extension in the driver of ballscrew gearbox No. 2, ensuring proper alignment (Ref. Fig.501 and 502).

NOTE: To satisfy high quality operational standards and maintain required accuracy of readings obtained during the test, it is recommended that all instrumentation used be calibrated on a periodic basis.

(3) Ensure that the system has been rotated off internal



Location of Bucket System Components
Figure 501

A

ACCESS COVER TO THE BALLSCREW GEARBOX DRIVER

B

B

BOLT

COVER

DRIVER

CMS 78 30 00 5 BAMO

Preparation for Measurement of Bucket System Drag Torque
Figure 502

ballscrew gearbox stops before measuring drag torque.

(4) Rotate torque wrench at a smooth and constant speed of approximately one revolution per ten seconds, for a minimum of five revolutions. Observe torque indication and record maximum value obtained.

(5) Repeat step (4) with rotation in the opposite direction.

(6) The highest drag torque obtained in either direction shall not exceed 0,2 daN.m (17.5 lbf.in).

(a) If the value obtained is below the specified limit:

1. Reinstall the access cover to the bucket ballscrew gearbox and torque tighten the two bolts to 0.30 daN.m (25 lbf.in).

2. Reinstall the access panel to the ballscrew gearbox and torque the fitting screws to 0,60 daN.m (53 lbf. in) using a pneumatic vibration screwdriver pre-adjusted at the required torquing value and equipped with an appropriate screwdriver head.

<u>CAUTION:</u> USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.

USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO DETERIORATION OF THE SCREWS.

(b) If value obtained exceed the specified limit, isolate and correct malfunction.

D. Isolating malfunction on the Thrust Reverser System

(1) Inspect flexible shaft assemblies for possible binding by checking casing assembly for damage and tight bend radius. No damage on the casing is permitted. Refer to Table 502 for acceptable minimum bend radius.

<u>NOTE:</u> For flexible shaft casing assemblies inspection, reference shall be made to 78-34-01, Removal/Installation, as required.

FLEXIBLE SHAFT ASSEMBLY (REF. FIG. 501)	MINIMUM BEND RADIUS
A, B, C, D	254 mm (10 in.)
E, F	305 mm (12 in.)

Flexible Shaft Assemblies Minimum Bend Radius
Table 502

(2) If a flexible shaft assembly does not meet requirements of Table 502, it shall be removed and inspected for casing assembly damage prior to re-installation at an acceptable bend radius. Extreme care shall be taken during installation to ensure that optimum bend radius for each flexible shaft assembly is achieved.

(3) If flexible shaft assembly is within required limits of Table 502 and has no apparent casing assembly damage, disconnect flexible shaft assemblies C and D at ballscrew gearboxes 3 and 4 (Ref. Fig. 501).

(4) Without ballscrew gearboxes No.3 and 4 bucket position transmitter (indicator) and flexible shaft assemblies A or B connected, repeat step C (4) and (5).

(5) Subtract highest value thus obtained from value obtained in step C (6).

(6) If difference obtained is greater than 0,06 daN.m (5.5 lbf. in), verify drag torque of ballscrew gearboxes No.3 and 4, bucket position transmitter (indicator) or flexible shaft assemblies A or B (Ref. Table 503).

COMPONENT (REF. FIG. 501)	MAXIMUM DRAG TORQUE (LBF.IN)
Pneumatic Drive Actuator	1.00
Ballscrew Gearboxes No. 1 through 4	1.50
Bucket Position Transmitter (Indicator)	1.50
Flexible Shaft Assembly A or B	0.75
Flexible Shaft Assembly C or D	2.00

COMPONENT (REF. FIG. 501)	MAXIMUM DRAG TORQUE (LBF.IN)
Flexible Shaft Assembly E	1.00
Flexible Shaft Assembly F	2.00

Thrust Reverser Components Maximum Allowable Drag Torque
Table 503

(7) If value obtained is less than or equal to 0,06 daN.m (5.5 lbf.in), disconnect flexible shaft assemblies C and D from ballscrew gearboxes l and 2 (Ref. Fig. 501).

(8) Without ballscrew gearboxes No.3 and 4, bucket position transmitter (indicator) and flexible shaft assemblies A or B, C and D connected, repeat steps C (4) and (5).

(9) Subtract highest value obtained from value obtained in step C (6).

(10) If difference obtained is greater than 0,11 daN.m (10 lbf.in), check drag torque of flexible shaft assemblies C and D (Ref. Table 503).

(11) If difference obtained is less than or equal to 0,11 daN.m (10 lbf.in), check drag torque of ball-screw gearboxes No.1 and 2, pneumatic drive actuator and flexible shaft assemblies E and F (Ref. Table 503).

(12) Replace malfunctioning component as determined in steps (1) through (11) and install flexible shaft assemblies within requirements of Table 503. Extreme care shall be taken during installation to ensure that optimum bend radius for each flexible shaft assembly is achieved.

NOTE: Reference shall be made to 78-34-01, Removal/Installation for the correct installation of flexible shaft assem= blies.

THRUST REVERSER - INSPECTION/CHECK

1. General

This chapter defines the inspection to be carried out following the use of reverse at high Power.
Malfunction of the engine control unit (E.C.U.) can lead to an overshoot of the specified reverse limitation. Should such an overshoot occur, a detailed visual inspection of the thrust reverser must be performed.

2. Examine the Thrust Reverser

A. Equipment and Materials

DESCRIPTION	PART No.
R Extension	9970-515-296
Circuit breaker safety clips	
Pneumatic vibration screwdriver (pre-adjusted at 0.60 daN.M, 53 lbf. in) and the appropriate screwdriver head	
Pneumatic impact wrench (unscrewing mode) ARO 8530 PC 1 and the appropriate screwdriver head.	

B. Prepare the Thrust Reverser for examination

(1) Electrically isolate the exhaust assembly Services indicated in table 601 by tripping the circuit breakers affecting the nacelle upon which work is being carried out. Fit circuit breakers safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP.REF.
Engine No.1			
Bucket cont unit sup	14-215	1K1132	E12
Rev thrust cont	3-213	1K331	D 1
Engine No.2			
Bucket cont unit sup	13-215	2K1132	G14
Rev thrust cont	1-213	2K331	B 5
Engine No.3			

SERVICE	PANEL	CIRCUIT BREAKER	MAP.REF.
Bucket cont unit sup	13-216	3K1132	C 6
Rev thrust cont	1-213	3K331	B 6
Engine No.4			
Bucket cont unit sup	14-216	4K1132	C 6
Rev thrust cont	3-213	4K331	D 2

Circuit breakers
Table 601

(2) Display a suitable placard on the engine starting panel indicating that personnel are working in the twin secondary nozzle area.

WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE ON WHICH WORK IS GOING TO BE CARRIED OUT.

(3) Remove the access panel to the upper lateral ball-screw gearbox (Ref. Fig. 601), using a pneumatic impact wrench equipped with an appropriate screw-driver head.

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.

USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

R BEFORE CARRYING OUT ANY WORK, THE SECONDARY
R NOZZLE MUST BE LINED WITH RUBBER CARPETS TO
R AVOID DAMAGE RESULTING FROM ACCIDENTIAL
R BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES
R MUST ALSO BE WORN WHEN STEPPING ON THE
R NOZZLE.

(4) Remove the access cover to the ballscrew gearbox driver (Ref. Fig. 601).

(5) Using the appropriate extension, move the buckets to the 73 degrees position, by turning the ballscrew

gearbox driver (Ref. Fig. 601).

C. Examine the thrust reverser

Detailed visual inspection of the secondary nozzle and thrust reverser, with special attention to :

(1) The ballscrew gearbox/bucket attachment mount on the bucket side.

(2) The rod of the ballscrew gearbox, looking for possible deformation (buckling) of the rod.

(3) The secondary nozzle/bucket seals
R (Ref.78-13-01, Fig 607).

D. Conclusion

(1) Using the appropriate extension, bring back the buckets to the 21 degrees position, by turning the ballscrew gearbox driver. The relevant bucket jack stroke X must be comprised within 76 and 96 mm (3.0 in. and 3.7 in.) (Ref. Fig. 601) (Detail A).

(2) Replace the access cover to the bucket ballscrew gearbox driver and torque tighten the two bolts to 0.30 daN.m (25 lbf. in).

(3) Reinstall the access panel to the ballscrew gearbox and torque the fitting screws to 0,60 daN.m (53 lbf. in) using a pneumatic vibration screwdriver pre-adjusted at the required torquing value and equipped with an appropriate screwdriver head.

<u>CAUTION:</u> USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.

USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

(4) Remove circuit breaker safety clips and reset all circuit breakers (Ref. Table 601).

A
X
BUCKET
ROD END BEARING
BALLSCREW GEARBOX
B
ACCESS COVER
ACCESS COVER
JACK DRIVER
BUCKET BALLSCREW GEARBOX
CMS 78 30 00 6 AAM0

Positioning the Buckets to an Angle of 73 Degrees
Figure 601

BUCKETS - REMOVAL/INSTALLATION

1. General

This topic details the removal/installation of the buckets or of some of their components. Removal of the buckets requires a 100 kg. (220 lb) capacity standard hoisting facility.

2. Buckets

A. Equipment and Materials.

DESCRIPTION	PART NO.
Extension	9970-515-296
Bucket lifting arm	E.93.5032.031
Bucket handling attachment	E.93.5032.030
Bucket falcrum extractor	E.92.5005.002
Bucket fulcrum installation device	E.92.5005.001
Temporary connecting pins	9970.525.530
Special wrench	852.500.083.0
Bucket storage and workstand	9970.521.069
Sling	E.93.5032.032
Anti-seizure compound	Lubricant S (Ref.70-00-01)
Torque wrench (0 to 3 daN.m in range 0 to 266 lbf. in.)	-
Circuit breaker safety clips	-
Pneumatic vibration screwdriver (pre-adjusted at 0,60 daN.m 53 lbf in.) and the appropriate screwdriver head.	-
Pneumatic impact wrench (unscrewing mode) ARO 8530 PC1 and the appropriate screwdriver head.	
Special wrench for rod end bearing	9970-511-093

B. Prepare to Remove Buckets (Ref. Fig.401 and 402).

(1) Electrically isolate the engine and exhaust assembly services indicated in Table 401 by tripping the circuit breakers affecting the engines in the nacelle on which work is being carried out.

WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR

IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE ON WHICH THE REMOVAL IS CARRIED OUT.

(2) Display a suitable placard on the engine starting panel, indicating that personnel are working on the engines and the twin secondary nozzle area.

SERVICE	PANEL	CIRCUIT BREAKER	MAP.REF.
ENGINE No.1			
BUCKET CONT UNIT SUP	14-215	1K1132	E12
REV THRUST CONT	3-213	1K331	D 1
ENGINE No. 2			
BUCKET CONT UNIT SUP	13-215	2K1132	G14
REV THRUST CONT	1-213	2K331	B 5
ENGINE No.3			
BUCKET CONT UNIT SUP	13-216	3K1132	C 6
REV THRUST CONT	1-213	3K331	B 6
ENGINE NO. 4			
BUCKET CONT UNIT SUP	14-216	4K1132	C 6
REV THRUST CONT	3-213	4K331	D 2

Circuit Breakers
Table 401

(3) Remove the access panel to the bucket pneumatic drive actuator, and to the upper lateral ballscrew gearbox, using a pneumatic impact wrench equipped with an appropriate screwdriver head (Ref. Fig. 401).

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD. USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO DETERIORATION OF THE SCREWS.
BEFORE CARRYING OUT ANY WORK, THE SECONDARY NOZZLE MUST BE LINED WITH RUBBER CARPETS TO AVOID DAMAGE RESULTING FROM ACCIDENTAL

BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES MUST ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

(4) Remove the access cover to the ballscrew gearbox driver (Ref. Fig. 401) (Detail B).

(5) Remove both deflectors and that of the adjacent bucket
B on the central wall side. Discard screws.

C. Remove the Bucket (Ref. Fig. 402, 403 and 404)

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(1) Using the appropriate extension, move the buckets to a position close to 45 degrees by turning the ballscrew gearbox driver (Ref. Fig. 401) (Detail B).

(2) Remove the ballscrew gearbox/bucket connecting yoke-pin on the sidewall side and replace it by a temporary pin.

(3) Remove the ballscrew gearbox/bucket connecting yoke-pin on the central wall side and replace it by a temporary connecting pin.

(4) Move the buckets to the zero degree position, hard
RB against the ballscrew gearbox stops, and come back
RB two turns towards the reverse position using the
RB ballscrew gearbox driver.

(5) Manually lock the bucket pneumatic drive actuator in this position (0 degrees + two turns towards reverse) (Ref. 78-33-06, Adjustment/Test).

(6) Remove the safety pins (Ref. Fig. 403).

(a) Unlock the two bolts (1).

(b) Unscrew the bolt (1) to remove the safety pin.

(c) Swing the locking pad (3) from the safety pin (2).

(d) Remove the safety pin (2) using the bolt (1).

(7) Remove the two bucket assembly screws (Ref. Fig. 402).

(a) Remove the counternut.

(b) Save the spacer.

(c) Remove the nut.

(d) Remove the assembly screw and save the washers.

(8) Attach the bucket handling attachment on the bucket, then hook it on the bucket lifting arm.

A

BUCKET

X

ROD END BEARING

BALLSCREW GEARBOX

B

ACCESS COVER

ACCESS COVER

JACK DRIVER

BUCKET BALLSCREW GEARBOX

CMS 78 31 01 4 AAM0

Buckets Removal/Installation - Access to Ballscrew Gearbox Driver
Figure 401

DETAIL OF BUCKET HINGE
NACELLE WALL SIDE

TWIN SECONDARY
NOZZLE

NUT

SPACER

COUNTERNUT

WASHER

FULCRUM

FULCRUM

WASHER

ASSEMBLY
SCREW

F

DEFLECTORS

F

TWIN SECONDARY
NOZZLE

FULCRUM

COUNTERNUT

SPACER

NUT

WASHER

ASSEMBLY
SCREW

DETAIL OF BUCKET HINGE
EXTERIOR SUPPORT SIDE

TWIN SECONDARY NOZZLE

CMS 78 31 01 4 BAMO

Prepare to Remove Buckets
Figure 402

R

CMS 78 31 01 4 CAMO

Removal of Safety Pins
Figure 403

R

(9) Actuate the hoisting device so as to take the weight of the bucket.

(10) Remove the ballscrew gearbox/bucket temporary connecting pins on the side wall side and on the central wall side.

(11) Remove the two bucket fulcrums using the appropriate extractor.

(12) Remove the bucket and install it on the appropriate bucket storage and workstand.

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D. Prepare to Install Bucket (Ref. Fig. 404)

(1) Clean and examine parts.

(2) Check visually for traces of knocks, or scratches.

(3) Smear all mating or hinge parts with lubricant S (Ref. 70-00-01).

RB NOTE: The bucket bearing is dry film lubricated -
RB DO NOT lubricate the spherical bearing surface.
RB Remove any excess lubricant which may
RB contaminate the bearing and cause the bearing
RB to seize.

(4) Attach the bucket handling attachment on the bucket, then hook it on the bucket lifting arm.

E. Install Bucket (Ref. Fig. 402, 403 and 404)

(1) Lift the bucket to its installation position.

(2) Position the bucket fulcrums using the appropriate installation device.

(3) Reassembly of safety pins (Ref. Fig. 403)

(a) Insert the safety pin (2).

(b) Place the locking pad (3) in position.

(c) Screw the bolt (1) and torque to between 44 and 53 lbf in (0.5 and 0.6 mdaN).

(d) Lock the two bolts (1) and secure them with 0.28 in (0.7 mm) diameter wire.

(4) Position the bucket fulcrum screws assembly and washers.

(5) Screw and torque the first nuts to between 14.8 and 22.2 (2.0 and 3.0 mdaN).

(6) Position the spacers.

(7) Screw and torque the counternuts to between 60 and 90 lbf in (0.7 and 1 mdaN).

(8) Remove the bucket handling attachment from the bucket.

CAUTION: IF THE INSTALLATION CONCERNS AN UPPER BUCKET, TAKE CARE TO SUPPORT IT TO PREVENT ITS ROTATION AND IMPACT ON THE LOWER BUCKET.

(9) Manually actuate the bucket and ensure that the travel is smooth and without hard spots.

B (10) Check the ballscrew gearbox drivers are set at two
B turns towards the reverse position.
B
B NOTE: This two revolution sequence corresponds to a
B deployment of the gearbox rod of 0.064 in
B (1.6 mm) (Ref. Fig. 401 dimension X).

(11) Position the bucket leading edge to abut on the secondary nozzle heat shield seal.

CAUTION: THE SEAL MUST NOT BE COMPRESSED.

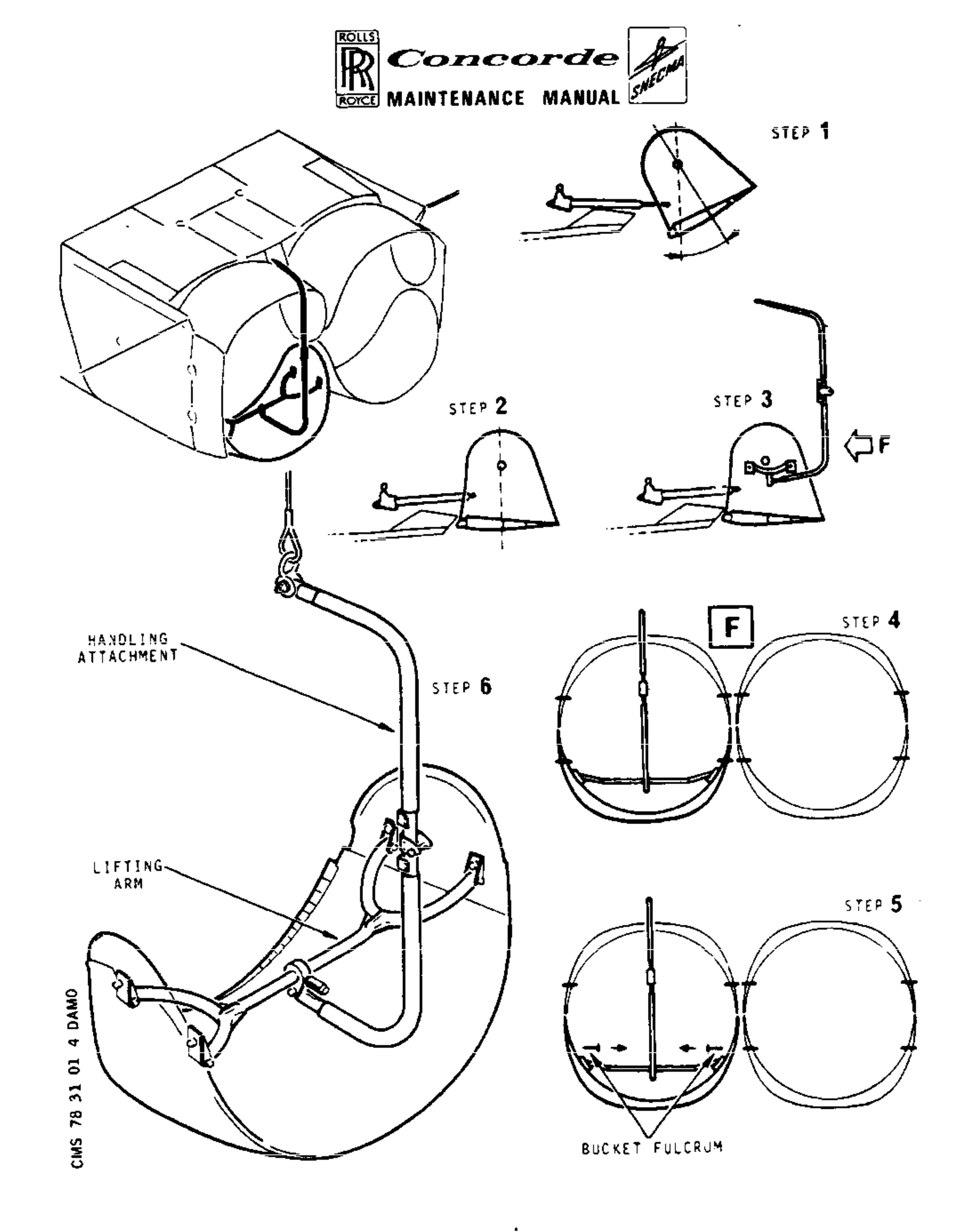
(12) Offer-up the ballscrew gearbox rod end bearing and if necessary adjust the length as follows (Ref. Fig. 405).

CAUTION: IN THE COURSE OF THIS OPERATION THE STOP ASSEMBLY MUST NOT ROTATE OUT OF THE AS RIGGED POSITION. THIS COULD LEAD TO SYSTEM DAMAGE.

(a) Cut the lock-wire from the lock-nut and lock-pin.

(b) Unscrew the lock-nut until the lock-pin is free, using the special wrench to hold the rod end bearing.

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Bucket Removal
Figure 404

F

BUCKETS IN
THRUST REVERSE POSITION
(BALLSCREWS HARD AGAINST STOP)

Y

POSITION OF ROD END BEARING
UNSCREWED BY N HALF-TURNS

POSITION OF ROD END
BEARING UNSCREWED BY
N HALF-TURNS
+ 1 HALF-TURN

ZONE
A

ZONE
B

BALLSCREW GEARBOX
DISPLACEMENT DIRECTION

BUCKET ATTACHMENT MOUNT
CENTERLINE

POSITION DEFINED
BY ABUTMENT OF
BUCKET LEADING EDGE
ON THE SECONDARY NOZZLE
HEAT SHIELD SEAL

STOP
ASSEMBLY

CMS 78 31 01 4 EAMO

F

WASHER

LOCK NUT

LOCK PIN

ROD END BEARING

Bucket Installation
Figure 405

(c) Unscrew the rod-end bearing by half turns to approach the bucket attachment. A half turn modifies the length by 0.025 in (0.6 mm).

- If the rod-end bearing centre line is slightly upstream of the bucket attachment mount centre line (Zone A) (Ref. Fig. 405), unscrew the rod-end by an extra half turn before fitting the temporary connecting pin.
- If the rod-end bearing centre line is slightly downstream of the bucket attachment mount centre line (Zone B) (Ref. Fig. 405), fit the temporary connecting pin.

(d) Measure the maximum gap between the seal and the bucket leading edge.

- If this gap is less than 0.098 in (2.5 mm) the adjustment is correct.

  CAUTION: THE SEAL MUST NOT BE COMPRESSED.

- If this gap is greater than 0.098 in (2.5 mm) rescrew the rod-end bearing by only one half turn and reinstall the temporary connecting pin.

(e) Once the rod end bearing is correctly adjusted, screw the lock-nut, making sure that the lock-pin is in correct position (Ref. Fig 405) (Detail F). Use the special wrench to hold the rod-end bearing.

(f) Torque tighten the lock-nut to 250 lbf in (2.8 mdaN).

(g) Wire-lock the lock-nut and lock-pin.

(13) Remove the manual lock on the bucket pneumatic drive actuator and place it on the "UNLOCKED" position (Ref. 78-33-06, Adjustment/Test).

(14) Using the appropriate extension, move the buckets to a position close to 45 degrees by turning the ballscrew gearbox driver (Ref. Fig. 401) (Detail B).

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(15) Remove the temporary connecting pins and secure the ballscrew gearbox rod-end bearings to the bucket assembly.

CAUTION: IF THE INSTALLATION CONCERNS AN UPPER BUCKET, TAKE CARE TO SUPPORT IT TO PREVENT ITS ROTATION AND IMPACT ON THE LOWER BUCKET.

(a) Install the rear attaching bolts complete with washers.

(b) Install the castellated nuts and torque tighten between 95 to 110 lbf in (1.10 and 1.25 mdaN).

(c) Lock the nuts with split pins.

F. Bucket/Ballscrew Gearbox Installation Checks

(1) Using the appropriate extension, move the buckets to the zero degree position by turning the ballscrew gearbox driver (Ref. Fig. 401 Detail B). Check all
B four ballscrew gearboxes are retracted to their hard
B stops. If adjustment is required refer to 78-32-19
B paras 2. C. to 2. E.

(2) With the buckets in the zero degrees position, check that there is no interference between the secondary nozzle structure and the bucket structure.

NOTE: If an interference is found between the secondary nozzle structure and the bucket structure unscrew the rod end bearing of the two bucket ballscrew gearboxes driving the bucket by an extra half turn.

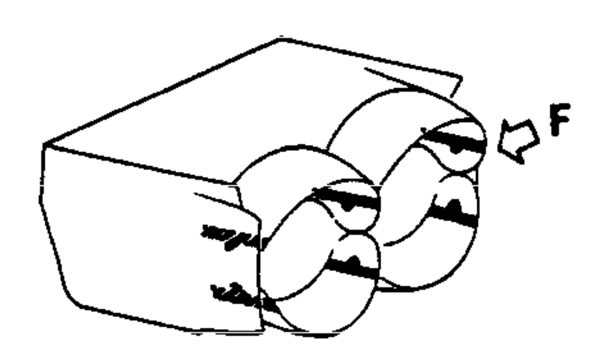
(3) Move the buckets to the 73 degree position, ballscrews hard against the stop. Dimension Y must be between 0.079 to 0.55 in (2 and 14 mm) (Ref. Fig. 405).

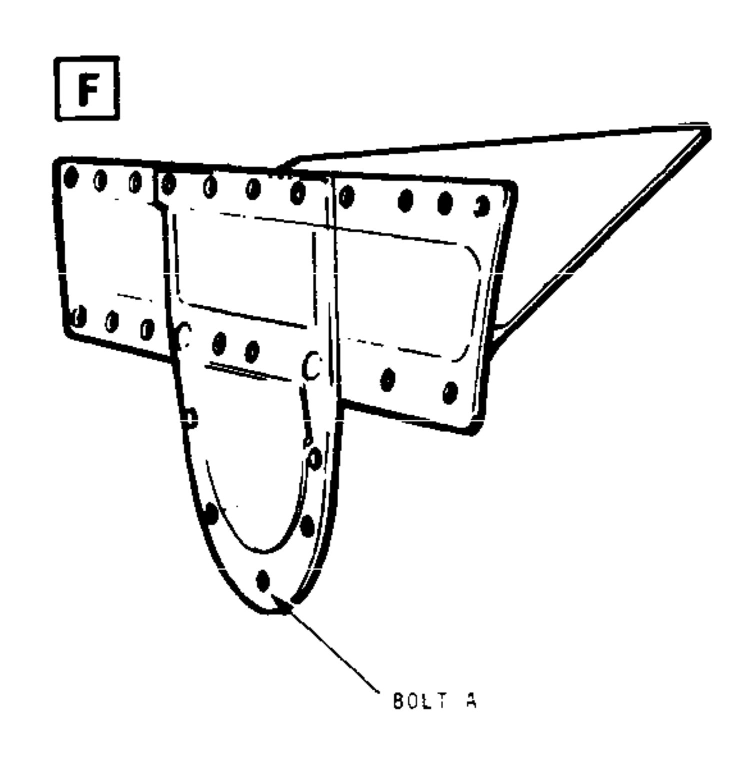
(4) Bring back the buckets to the 21 degree position. The relevant bucket jack stroke X must be between 3.0 in and 3.7 in (76 and 96 mm) (Ref. Fig. 401) (Detail A).

G. Final Installation

(1) Replace the access cover to the bucket ballscrew driver and torque tighten the two bolts to 25 lbf in (0.30 mdaN).

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CMS 78 31 01 4 FAMIO

Removal and Installation of Bucket Deflector
Figure 406

(2) Install the access panels to the bucket pneumatic drive actuator and to the bucket ballscrew gearbox. Torque the fitting screws to 53 lbf in (0.60 mdaN) using a pneumatic vibration screwdriver pre-adjusted at the required torquing value and equipped with an appropriate screwdriver head.

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD. USING MANUAL OR UNAPPROPRIATE TOOLS COULD ONLY LEAD TO DETERIORATION OF THE SCREWS.

B (3) Using new screws, install the three deflectors and
B torque all fixing screws at 5.9 to 6.7 lbf ft (0.80
B to 0.9 mdaN), except bolt A (Ref. Fig. 406) which
B should be torqued to 2.21 to 2.95 lbf ft (0.3 to
B 0.4 mdaN).

CAUTION: DEFLECTORS ATTACHMENT BOLTS MUST BE RETIGHTENED AFTER FIVE FLIGHTS.

(4) Reset all circuit breakers (Ref. Table 401).

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BUCKETS - INSPECTION/CHECK

1. General

This chapter defines the normal position of the buckets when the aircraft is on ground and the acceptance criteria related to damages affecting bucket assemblies.

CAUTION: BEFORE CARRYING OUT ANY WORK, THE SECONDARY NOZZLE MUST BE LINED WITH RUBBER CARPETS TO AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES MUST ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

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2. Check for Bucket Position

The bucket position check is essentially carried out visually. It is performed by lateral observation of the four buckets assemblies which must be all at the same angular position. When a bucket assembly shows some substantial angular variation in relation to the other, check that it is compatible with the in-line service by measuring the X jack stroke.

The bucket jack stroke X must be within 71 and 100 mm (2.8 and 3.9 in).

3. Bucket Assembly Visual Inspection

A. Electrically isolate the engine and exhaust assembly services indicated in Table 601 by tripping the circuit breakers affecting engines in the nacelle upon which work is being carried out. Fit circuit breakers safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENGINE NO. 1			
BUCKET CONT UNIT SUP.	14-215	1K1132	E12
REV THRUST CONT.	3-213	1K 331	D 1
ENGINE NO.2			
BUCKET CONT UNIT SUP.	13-215	2K1132	G14
REV THRUST CONT.	1-213	2K 331	B 5

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENGINE NO.3			
BUCKET CONT UNIT SUP.	13-216	3K1132	C 6
REV THRUST CONT.	1-213	3K 331	B 6
ENGINE NO.4			
BUCKET CONT UNIT SUP.	18-216	4K1132	C 6
REV THRUST CONT.	3-213	4K 331	D 2

Circuit Breakers
Table 601

WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE.

B. Display a suitable placard on the engine starting panel indicating that personnel are working on the engines and in the twin secondary nozzle area.

C. Examine the Bucket Assembly

(1) Check for condition of front seal.

(2) Check for condition of outer skin.

(3) Check that no primary heat shield attachment screw is missing.

(4) Check for failure of doubler attachment rivets.

D. Acceptance Criteria
(Ref. Fig. 601, 602 and 603)

(1) Compare bucket damage with the criteria specified on the series of appropriate illustration sheets.

(2) If damage exceeds the specified dimensions, reject the component for rectification.

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CROSS SECTION XX OF BUCKET

FIRST FRAME

SECOND FRAME

THIRD FRAME

FRONT EDGE

OUTER PANEL

INNER PANEL

A

X

DAMAGE ON THE OUTER SKIN PANEL AND ON THE FRONT EDGE, SERVICEABLE PROVIDING NO DELAMINATION, NO CRACK AND NO PERFORATION REPORTED AT EACH RETURN TO MAIN BASE. REPAIR AT THE NEXT OPERATIONALLY CONVENIENT POINT.

IF CASE OF NOT SEVICEABLE DAMAGE, THE REVERSE MUST NOT BE USED ON THE AFFECTED ENGINE.

WEAR OF FRONT SEAL ACCEPTABLE

X

S-OLY-MM-00078-00-8

Inspection of Bucket Assembly
Acceptance Criteria
Figure 601

CMS 78 31 01 6 BAMO

A

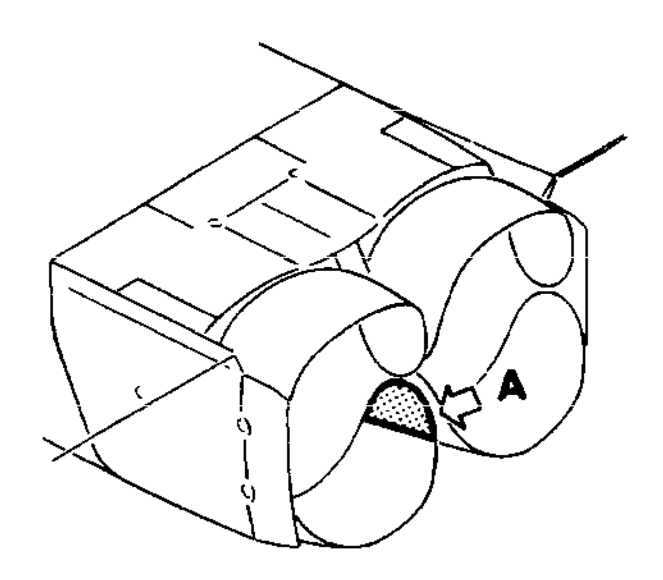
ONE ATTACHMENT SCREW MISSING ON SIDE EDGES UNACCEPTABLE

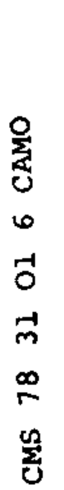
CENTERING POINT

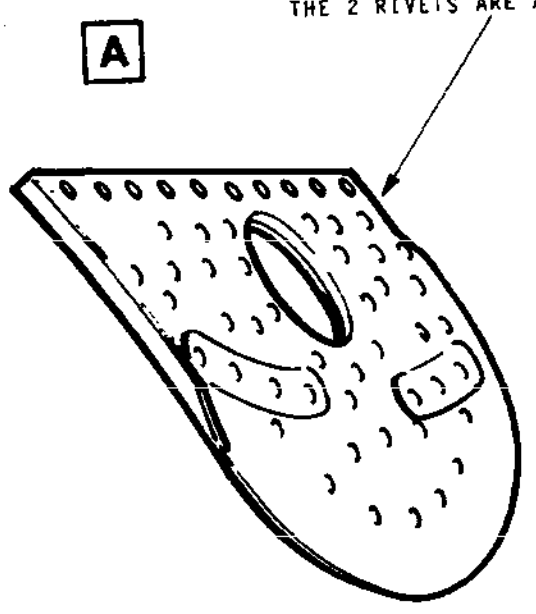
ONE ATTACHMENT SCREW MISSING ACCEPTABLE WITH THE EXCEPTION OF THE CENTERING AND/OR GUIDING POINTS

GUIDING POINT

Inspection of Bucket Assembly
Corrugated Primary Heat Shield - Acceptance Criteria
Figure 602







Inspection of Bucket Assembly
Side Plate - Acceptance Criteria
Figure 603

GROUND CONNECTION - REMOVAL/INSTALLATION

WARNING: OBSERVE THE DOOR OPENING SAFETY PRECAUTIONS IN 71-00-00, SERVICING.

1. General

A ground connection is located in each engine bay at the bottom of the rear centre wall panel. The connection is secured to a centre wall half clamp and bracket.

To gain access to a connection open the engine bay forward and rear lower doors to the servicing position.

2. Ground Connection

A. Equipment and Materials

DESCRIPTION	PART NO
Torque spanner range: 50-60 lbf in (0.56-0.67 mdaN)	-
Corrosion resistant steel wire 0.028 in (0.71 mm) dia.	-

B. Prepare

(1) Open and support the engine bay lower doors to the servicing position (Ref. 71-00-00, Servicing).

(2) Locate the ground connection on the engine bay rear centre wall.

C. Remove (Ref. Fig. 401)

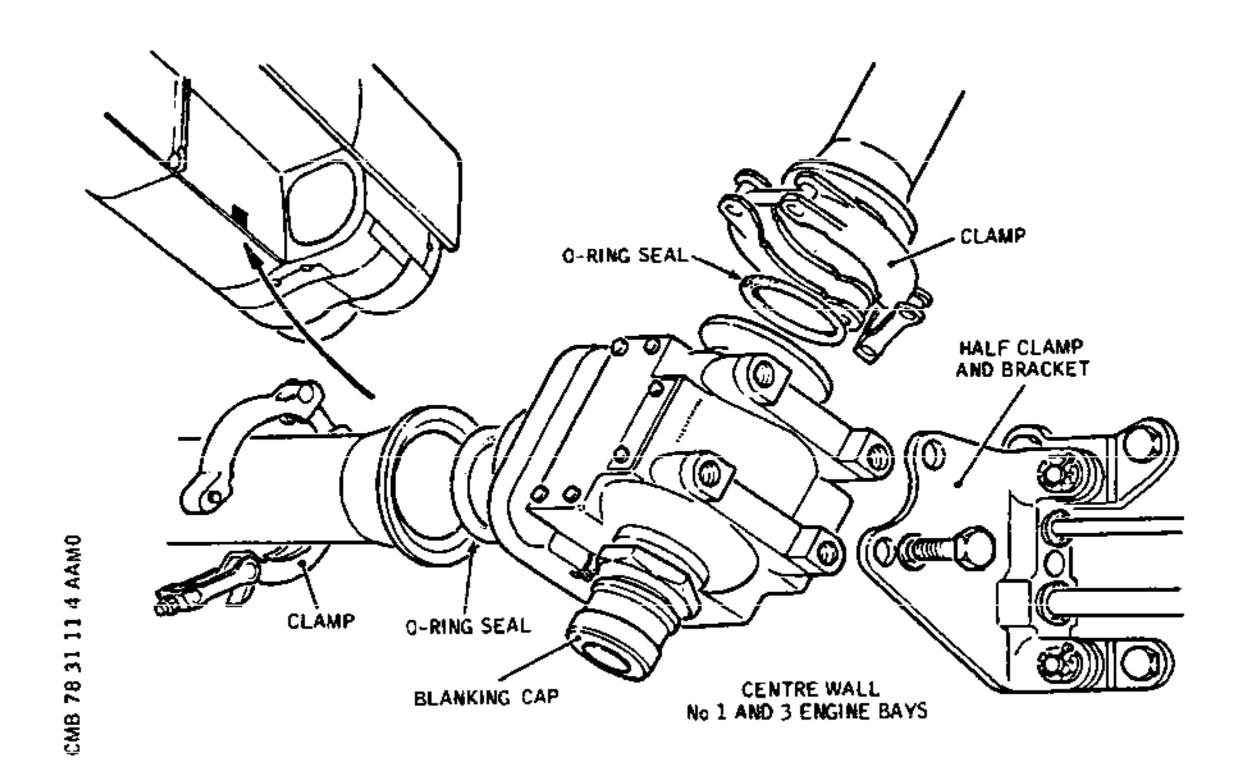
(1) Slacken the nuts securing each of the pipe clamps; remove the clamps.

(2) Remove the locking wire from the bolts securing the ground connection.

(3) Support the ground connection and remove the bolts securing it to the half clamp and bracket; retain the washers.

(4) Remove the ground connection; collect and dispose of the pipe O-ring seals.

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\- Ground Connections - Installation
Figure 401

(5) Fit approved blanks to the pipe ends and to the apertures on the connection.

D. Prepare to Install

(1) Comply with the door opening safety precautions.

(2) Remove the blanks from the pipe ends and the apertures on the ground connection.

(3) Check that the pipe seatings are clean and undamaged.

E. Install

NOTE: Assemble pipe couplings to Chapter 20-23-11.

(1) Using a new O-ring seal for each pipe, engage the ground connection with the pipe ends and with the half clamp and bracket. Secure the connection to the

half clamp and bracket with bolts and washers.

(2) Secure each pipe with a pipe clamp; torque load each pipe clamp nut to 53 lbf in (0.6 mdaN).

(3) Torque load the half clamp and bracket bolts to between 50 and 60 lbf in (0.56 - 0.67 mdaN), and lock with wire in accordance with Chapter 20-21-13.

R CAUTION: FAILURE TO CORRECTLY REPLACE AND SECURE THE
R BLANKING CAP COULD RESULT IN HOT AIR LEAKAGE
R WITH CONSEQUENT DAMAGE TO ADJACENT WIRING
R LOOMS AND COMPONENTS.

(4) Check that the blanking cap on the ground connector is secured and wire-locked.

F. Conclusion

(1) Carry out the static functional test in 78-00-00, Adjustment/Test.

(2) Check that the area is clean.

(3) Close and lock the engine bay(s) doors (Ref.71-00-00, Servicing).

TELESCOPIC TUBE - REMOVAL/INSTALLATION

1. General

This topic details the removal/installation of the telescopic tube.

The telescopic tube is located in the bucket pneumatic drive actuator compartment and connects the unit to the P3 air supply tube. It facilitates the removal/installation of the bucket pneumatic drive actuator, and provides the P3 flow continuity without mechanical strains at the connecting points.

2. Removal/Installation of the Telescopic Tube

A. Equipment and Materials

DESCRIPTION	PART NO.
Pneumatic vibration screwdriver (preadjusted at 0,60 daN.m, 53 lbf.in.) and the appropriate screwdriver head.	
Pneumatic impact wrench (unscrewing mode) ARO 8530 PC 1 and the appropriate screwdriver head.	
R 3 bars (43 psig) air pressure source.	
Circuit breaker safety clips	

B. Prepare to remove the telescopic tube (Ref. Fig. 401)

(1) Electrically isolate the engine and exhaust assembly services indicated in Table 401 by tripping the circuit breakers affecting engine in the nacelle upon which work is being carried out. Install breaker safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINE No. 1			
BUCKET CONT UNIT SUP	14-215	1K1132	E12
REV THRUST CONT	3-213	1k331	D 1

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINE No. 2			
BUCKET CONT UNIT SUP	13-215	2K1132	G14
REV THRUST CONT	1-213	2K331	B 5
ENGINE No. 3			
BUCKET CONT UNIT SUP	13-216	3K1132	C 6
REV THRUST CONT	1-213	3K331	B 6
ENGINE No. 4			
BUCKET CONT UNIT SUP	14-216	4K1132	C 6
REV THRUST CONT	3-213	4K331	D 2

Circuit Breakers
Table 401

WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE ON WHICH THE REMOVAL IS CARRIED OUT.

(2) Display a suitable placard on the engine starting panel,
R indicating that personnel are working on the engine and twin secondary nozzle area.

(3) Using a pneumatic impact wrench equipped with an appropriate screwdriver head, remove the respective access panel to the bucket pneumatic drive actuator (Ref. Fig.401).

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD. USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

BEFORE CARRYING OUT ANY WORK, THE SECONDARY NOZZLE MUST BE LINED WITH RUBBER CARPETS TO AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES MUST ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

C. Removal of the Telescopic Tube

R CAUTION: DO NOT REMOVE THE RETAINING PLATE (Ref. Fig.401).

R (1) Remove the clamp securing the P3 air supply elbow on the pneumatic drive actuator and discard the sealing ring.

(2) Remove the P3 air supply elbow.

(3) Tilt the telescopic tube to disengage it from the retaining plate.

(4) Remove the telescopic tube.

D. Install the Telescopic Tube

R
R
R <u>CAUTION:</u> THE NON-APPLICATION OF THIS DRILL WOULD PROBABLY LEAD TO AN INADVERTENT MOVEMENT OF THE BUCKETS TOWARDS THE REVERSE POSITION.

R
R
R
R <u>CAUTION:</u> INTRODUCTION OF ANY ANTI-SEIZE OR LUBRICATING PRODUCT IS STRICTLY FORBIDDEN. SEND THE TELESCOPIC TUBE TO SHOP FOR MAINTENANCE WHEN FOUND STIFF TO MOVE DURING GROUND MAINTENANCE.

R
R (1) Ensure telescopic tube is installed the correct way round (Ref. Fig.401).

R
R (2) Ensure foolproof ring is present to telescopic tube (Ref. Fig.401).

R
R
R (3) Engage lip of spherical seal at large diameter end with the retaining plate. Check lip has engaged by giving tube a sharp pull away from plate.

R
R
R (4) If retaining plate has been removed do not tighten retaining bolt until telescopic tube is fully engaged on the spherical seal.

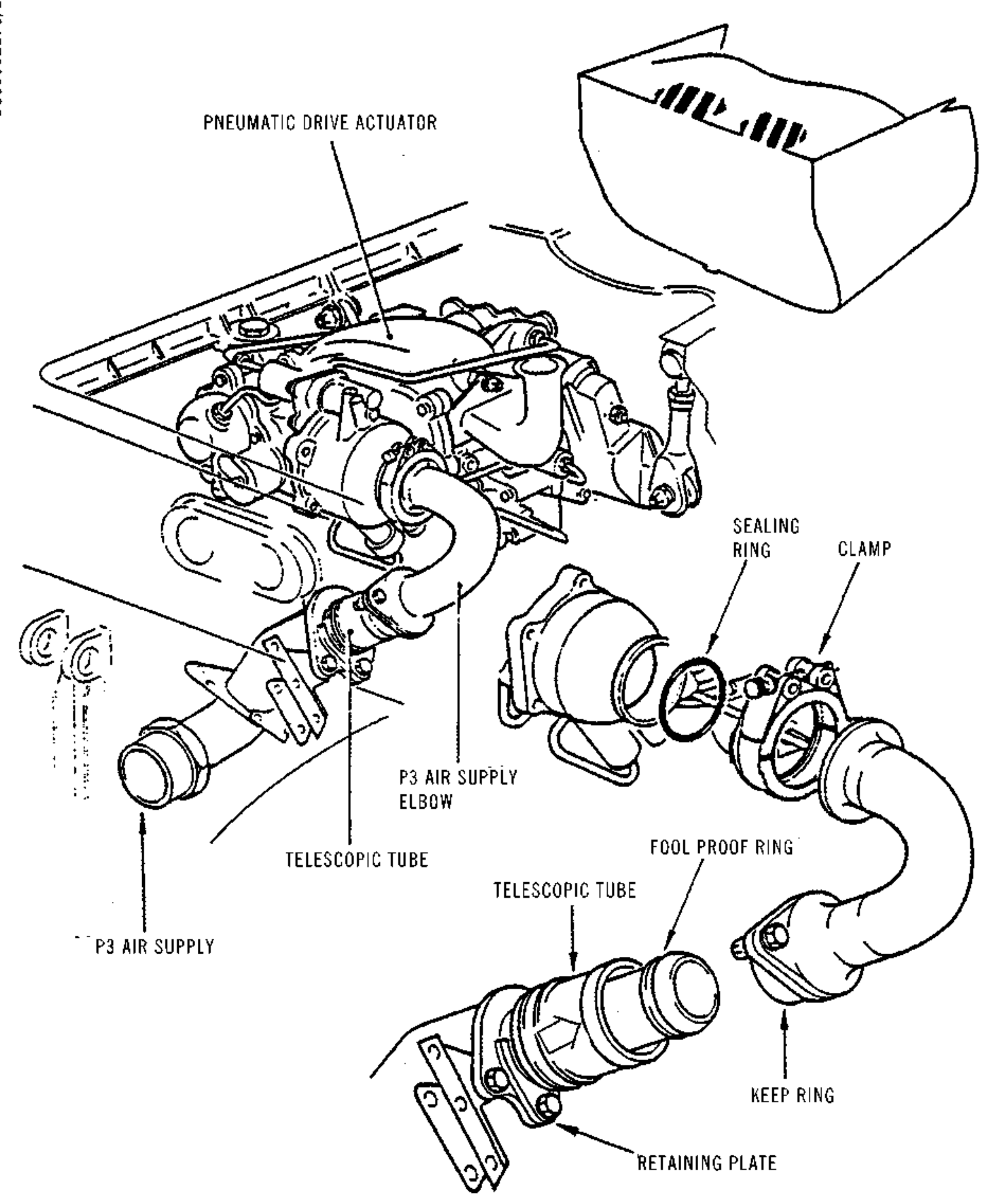
R <u>CAUTION:</u> TAKE CARE NOT TO MIX DIFFERENT SUPPLY ELBOWS. ELBOWS FOR BAYS 1-3 ARE DIFFERENT FROM ELBOWS FOR BAYS 2-4.

R (5) Engage the inner cylinder of the telescopic tube in the telescopic tube keep ring installed on the P3 air supply elbow.

R (6) Position a new sealing ring and install the clamp securing the P3 air supply elbow to the bucket pneumatic drive actuator.

R
R
R
R

R
R
R
R



Removal/Installation of the Telescopic Tube
Figure 401

R CAUTION: ELBOW AND TELESCOPIC TUBE MUST BE PROPERLY
R ALIGNED TO AVOID HOT AIR LEAKS WHICH MAY
R LEAD TO INADVERTENCE REVERSE.

R (7) Check that the sealing ring seats correctly. Position
R and slightly tighten the P3 air supply elbow to
R properly align the elbow with the telescopic tube.

(8) Torque tighten the clamp bolt from 115 to 133 lbf in
R (1,3 to 1,5 mdaN).

R (9) After P3 air supply elbow has been fitted check that
R the telescopic tube is still engaged by giving sharp
R pull away from retaining plate.

E. Telescopic Tube Installation Checks

(1) Carry out the telescopic tube air leak check IAW
R page 501, paragraph 2 A-B-C-D.

F. Final Installation

(1) Replace the access panel to the bucket pneumatic drive actuator.

R CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD. USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

(2) Torque the attaching screws to 53 lbf in (0,60 mdaN) using a pneumatic vibration screwdriver preadjusted at the required torque value and equipped with an appropriate screwdriver head.

(3) Reset all circuit breakers (Ref. Table 401).

TELESCOPIC TUBE - ADJUSTMENT/TEST

1. General

The best procedure described in this chapter must be carried out after installation of the Bucket Pneumatic Drive Actuator (BPDA) or the telescopic tube on the aircraft, or whenever it is deemed necessary to ascertain that there are no abnormal leaks in the BPDA bay.

2. Air Leak Check

A. Equipment and Material

DESCRIPTION	PART NO.
Ground air source 3 bars (43 psig)	-
Pneumatic impact wrench ARO	-
Circuit breaker safety clips	-
Torque wrench 0 to 30 lbf in (0 to 4 mdaN) range	-

B. Prepare to Perform the Leak Check

WARNING: BEFORE CONNECTING ANY AIR SOURCE TO THE GROUND TEST CONNECTOR, ENSURE THAT AREAS ADJACENT TO THE TWO BUCKET SYSTEMS OF THE TWIN SECONDARY NOZZLE ARE CLEAR OF PERSONNEL AND EQUIPMENT.

CAUTION: AFTER COMPLETION OF ANY TEST NECESSITATING AN EXTERNAL AIR SOURCE, IT IS IMPERATIVE TO BLANK THE GROUND TEST CONNECTOR WITH THE PIPE CLOSURE NUT AND LOCKWIRE.

(1) Electrically isolate the engine and exhaust assembly services indicated in Table 501 by tripping the circuit breakers affecting engines in the nacelle upon which work is being carried out. Install circuit breaker safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENGINE No. 1			
BUCKET CONT UNIT SUP	14-215	1K1132	E12
REV THRUST CONT	3-213	1K331	D 1
ENGINE No. 2			
BUCKET CONT UNIT SUP	13-215	2K1132	G14
REV THRUST CONT	1-213	2K331	B 5
ENGINE No. 3			
BUCKET CONT UNIT SUP	13-216	3K1132	C 6
REV THRUST CONT	1-213	3K331	B 6
ENGINE No. 4			
BUCKET CONT UNIT SUP	14-216	4K1132	C 6
REV THRUST CONT	1-213	4K331	D 2

Circuit Breakers
Table 501

(2) Remove the BPDA (bucket motor) access panel for the engine position upon which work is being carried out.

ENGINE POSITION	PANEL
No.1	418AT
No.2	427AT
No.3	438AT
No.4	447AT

(3) Check the telescopic tube.

(a) Carry out a visual and tactile inspection of the telescopic tubes to check for security between the engine P3 pipe and bucket motor pipe. Check that tube is "expanded" to provide a tight seal at both ends.

(b) If the telescopic tube is found to be stiff, do not apply any anti-seize or lubricating product and change the telescopic tube at shop visit. Refer to Removal/Installation.

(4) As required, open and secure front and rear engine bay doors.

(5) Cut and remove lockwire. Unscrew and remove the pipe closure nut from the ground test connector.

C. Telescopic Tube Air Leak Check

<u>WARNING:</u> BEFORE CONNECTING THE AIR SOURCE, ENSURE THAT PERSONNEL AND EQUIPMENT ARE CLEAR OF THE AREA SURROUNDING THE BUCKETS. WHEN AIR IS SUPPLIED TO THE GROUND TEST CONNECTOR, THE BUCKETS WILL MOVE TO THE ZERO DEGREES POSITION.

(1) Connect 3 bars (43 psig) compressed air to ground test connector.

(2) Check the telescopic tube.

(a) Check for air leaks all around the body of the telescopic tube, paying particular attention to the mating face.

<u>NOTE:</u> In the zero degrees position, the bucket motor ASOV is "shut", providing the highest air pressure on the telescopic tube.

(b) Reject the telescopic tube if it is found to be leaking and replace it. Refer to Removal/Installation.

(c) If the telescopic tube is found to be stiff, do not apply any anti-seize or lubricating product and change the telescopic tube at shop visit. Refer to Removal/Installation.

D. Final Installation

<u>WARNING:</u> BEFORE RESETTING THE CIRCUIT BREAKERS, ENSURE THAT PERSONNEL AND EQUIPMENT ARE CLEAR OF THE AREA SURROUNDING THE BUCKETS. WHEN THE CIRCUIT BREAKERS ARE RESET, THE BUCKETS WILL MOVE TO THE 21 DEGREES POSITION.

(1) Reset circuit breakers. Refer to Table 501.

R (2) Disconnect ground air supply and re-blank the ground test connector. Torque the pipe closure nut to 3,5 mdaN (25.81 lbf in) and lockwire.

R (3) Close front and rear bay doors.

R (4) Replace the access panel to the bucket pneumatic drive actuator.

R CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD. USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

R (5) Torque the attaching screw to 0,60 mdaN (53 lbf in) using a pneumatic vibration screwdriver preadjusted at the required torque value and equipped with an appropriate screw-driver head.

REVERSE THRUST THROTTLE SWITCH PACKS - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS IN CHAPTER 24-00-00

1. General

The four reverse thrust switch packs are located below and aft of the throttle lever quadrants. All four switches are attached to a single transverse mounting bracket which in turn is bolted to the console support casting. The operating plunger of each switch engages with its respective throttle lever operated cam.

2. Reverse Thrust Throttle Switch Packs

A. Equipment and materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
R Tool, contact, insertion-extraction	NAS1664-20
Droop nose uplock safety pins (2)	D92-5188-002
Torque spanner, range 0-120 lbf in (0-1.34 mdaN)	-
Vidaflex	BA/7857-M017-C
PTFE tape	BAS 8080-29
R Locking wire 0.031 in (0.8 mm),	DTD189

B. Prepare to Remove Reverse Thrust Throttle Switch
R Packs (Ref. Fig. 401)

(1) Electrically isolate the relevant services in the centre console by tripping the circuit breakers and securing them with safety clips.

NOTE: For electrical isolation, the circuit breakers listed for Auto-Throttle, Air Conditioning, Visor/Droop Nose and Floor Lights must be tripped in addition to those for the appropriate switch pack.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
	AFCS 1 CONT	1-213	1C19	Q14
	AT 1 CONT	1-213	1C180	Q12
	AFCS 2 CONT	5-213	2C19	A12
	AT 2 CONT	5-213	2C180	A14
	SYS 1 GRND PRESSN CONT	15-215	H1157	E 3
	SYS 1 DITCHING VALVE CONT	1-213	H1149	G13
	SYS 1 FWD & AFT DISCHARGE VALVE SUP	5-213	H1125	E 8
	SYS 2 GRND PRESSN CONT	15-216	H1158	D23
	SYS 2 DITCHING VALVE CONT	1-213	H1150	F10
	SYS 2 FWD & AFT DISCHARGE VALVE SUP	1-213	H1124	E13
	CABIN OVER PRESS IND	5-213	H1126	E 9
	NOSE 7 1/2° CONT	1-213	M12	Q16
	VISOR & NOSE CONT	15-215	M11	F 8
	NOSE/VISOR STBY LOWER SUP	1-213	M13	Q17
	CHARTS STOWAGE LTS SUP	15-216	L237	D12

Throttle Switch Pack/Engine No.1

	ENG 1 REHEAT CONT	15-216	1K1542	E 9
	ENG 1 WIND DOWN CONT SUP 1	5-213	1K1101	B 1
	ENG 1 WIND DOWN CONT SUP 2	1-213	1K1108	C 7
	ENG 1 REV THRUST CONT	3-213	1K331	D 1
R	ENG 1 PP MGT LTS SUP	5-213	1E461	D 1

Throttle Switch Pack/Engine No.2

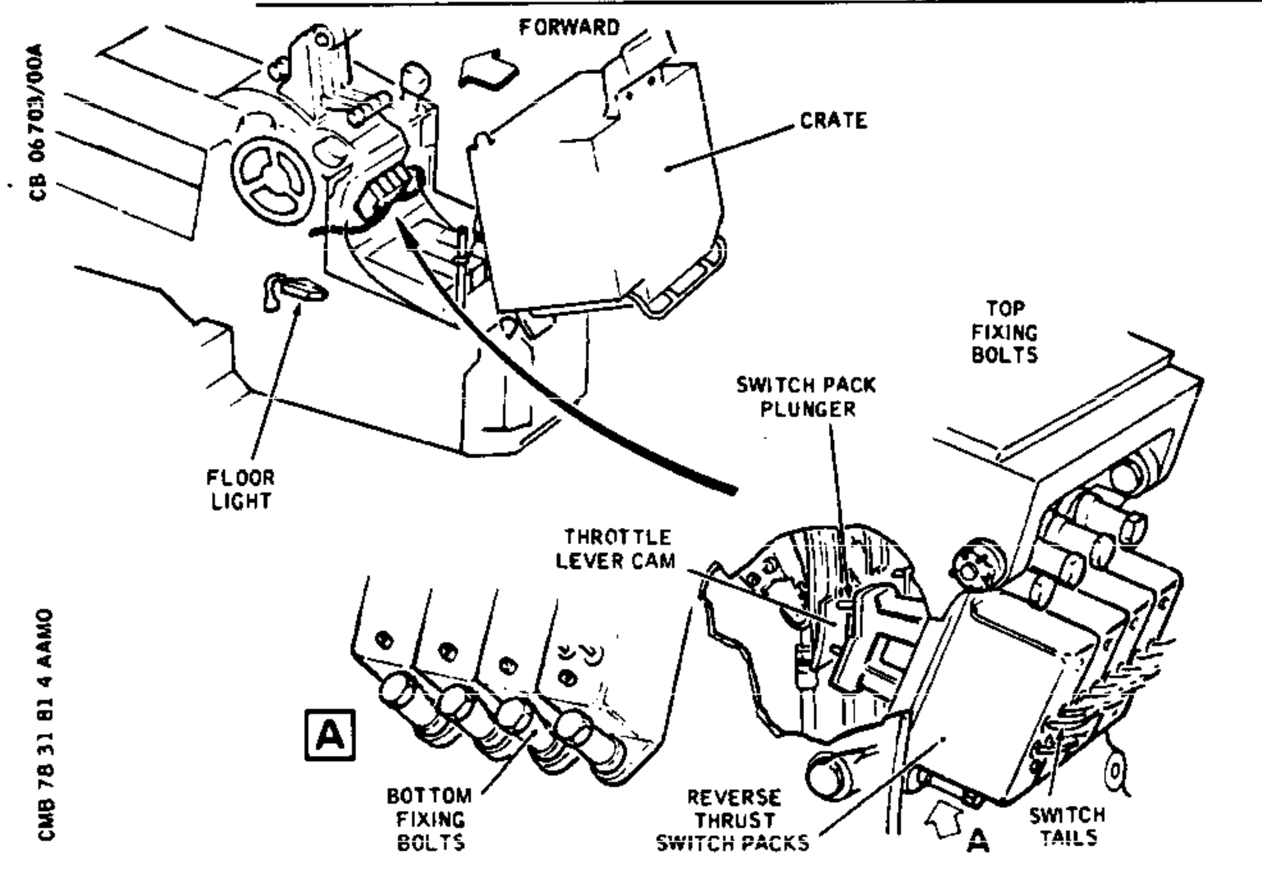
	ENG 2 REHEAT CONT	15-215	2K1542	D15
	ENG 2 WIND DOWN CONT SUP 1	1-213	2K1101	F 4
	ENG 2 WIND DOWN CONT SUP 2	5-213	2K1108	C 1
	ENG 2 REV THRUST CONT	1-213	2K331	B 5
R	ENG 2 PP MGT LTS SUP	1-213	2E461	E 3

Throttle Switch Pack/Engine No.3

	ENG 3 REHEAT CONT	15-215	3K1542	D16
	ENG 3 WIND DOWN CONT SUP 1	1-213	3K1101	F 5
	ENG 3 WIND DOWN CONT SUP 2	5-213	3K1108	C 2
	ENG 3 REV THRUST CONT	1-213	3K331	B 6

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SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
R ENG 3 PP MGT LTS SUP	1-213	3E461	E 4
Throttle Switch Pack/Engine No.4			
ENG 4 REHEAT CONT	15-216	4K1542	E10
ENG 4 WIND DOWN CONT SUP 1	5-213	4K1101	B 2
ENG 4 WIND DOWN CONT SUP 2	1-213	4K1108	C 8
ENG 4 REV THRUST CONT	3-213	4K331	D 2
R ENG 4 PP MGT LTS SUP	5-313	4E461	D 2



R Reverse Thrust Throttle Switch Packs
Figure 401

(2) If nose is up, fit one safety locking pin to each of the two nose uplocks.

(3) Remove the centre console side panels:

(a) Release the screws securing the forward and aft side panels and remove the forward panels.

(b) Ease the aft panels away from the console structure and disconnect the electrical plugs for the pilots' floor illumination at the receptacles, U2025 on the left-hand panel and U2026 on the right-hand panel.

(c) Remove the left-hand panel.

(d) Disengage the droop nose emergency drop control handle from its stowage on the right-hand aft panel by pulling the ring on the pip-pin, taking great care not to rotate the handle.

(e) Ease the aft panel away from the console structure, insert hand between panel and structure and depress the release stud on the shaft end of the control handle. Carefully withdraw the handle from its shaft.

(f) Remove the aft panel.

(4) Place the four throttle levers in the IDLE position.

(5) Remove the screws securing the check list stowage at the rear of the console crate; remove the stowage at the rear of the console crate; remove the stowage.

(6) Remove the two fixing screws and hinge back the crate.

C. Remove Reverse Thrust Throttle Switch Packs (Ref. Fig. 401)

R B NOTE: When removing/installing the "Reverse Thrust
R B Throttle Switch Packs" make an entry in the
R B Aircraft Technical Report (Sector Defect Log)
R B that a secondary nozzle ASOV check must be
R B carried out on departure from that station/
R B base.

(1) Release switch pack cable loom clipping.

(2) Disconnect the switch pack wire tails from terminal blocks UM2068, 2070, 2071 and/or 2072.

(3) Release the two captive bolts on each of the switch packs to be removed and withdraw switch packs complete with wire looms.

D. Install Reverse Thrust Throttle Switch Packs (Ref. Fig. 401)

(1) Comply with electrical safety precautions

(2) Ensure that the two safety pins are engaged in the droop nose uplocks.

(3) Ensure that the switch pack areas within the console are clean.

(4) Position the switch packs on the console structure and secure each switch by the
R two captive screws, torque-tighten to 25-30 lbf in (0.28 - 0.34 mdaN).

R (5) Using steel wire 0.031 in (0.8 mm) dia.
R wire-lock the switch fixing bolts in two groups of four (Ref.20-21-13).

(6) Using the insertion tool in accordance with W.D.M. (Ref.20-42-18) fit the leads/contacts to the to appropriate pin positions of the terminal block according to the cable identification and the applicable wiring diagram. Reassemble plugs and ensuring that mating surfaces are clean and undamaged, reconnect to the respective receptacles on console forward panel 10-211.

(7) Wrap the loom at the clip position using Vidaflex, then, ensuring that the wrapping extends approximately 0.125 in (3.175 mm) each side of the clip, secure the clips in position.

(8) Using PTFE tape, wrap the loom at lead junctions and where the loom may contact metal surfaces.

(9) Test the switch pack. (Ref. 78-31-81, Adjustment/Test).

E. Conclusion

(1) Install the centre console forward and aft side panels:

(a) Ensure that the console area is clean.

R (b) Attach the left-hand and right-hand forward panels and torque-tighten the fixing screws to 40-44 lbf in (0.45-0.51 mdaN).

(c) Loosely position the left-hand aft panel and connect the floor illumination electrical plug to receptacle ref. U2025 on the panel.

R R (d) Torque-tighten the panel fixing screws to 40-45 lbf in (0.45-0.51 mdaN).

(e) Loosely position the right-hand aft console panel and connect the floor illumination plug to receptacle ref. U2026 on the panel.

(f) Attach the droop nose emergency drop control handle by depressing the release stud on the handle and sliding the handle onto its shaft until the release stud mechanism engages with its housing in the shaft.

R R (g) Torque-tighten the panel fixing screws to 40-45 lbf in (0.45 - 0.51 mdaN).

(h) Stow the control handle by pressing the pip-pin into its housing on the panel.

(2) Check that crate area of console is clean, release the locking struts and hinge forward the crate.

R R (3) Insert the two fixing screws and torque-tighten to 70-80 lbf in (0.79 - 0.90 mdaN).

(4) Fit the check list stowage.

(5) Remove the two safety pins from the droop nose uplocks.

(6) Remove the safety clips and reset the circuit breakers which were not reset after the

Adjustment and Test operation.

R (7) Carry out an operational test of the centre console
R floodlights (Ref. 33-12-00, Adjustment/Test).

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REVERSE THRUST THROTTLE SWITCH PACKS - ADJUSTMENT TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The reverse thrust throttle switch packs are located inside the centre console casting and are accessible when the centre console crate is hinged back. When a throttle lever or switch pack mounting is changed, a switch pack in an otherwise fully serviceable condition may be checked using the following Tests 1 or 2. The adjustment para.4, is also required in addition to the test.

When a switch pack is changed, Test 3 must be applied.

The test instructions are given for No.1 throttle channel and should be repeated, as necessary, on the other throttle channels.

2. Switch Pack - Installation Tests 1 and 2 (Ref. Fig.501 and 502)

A. Equipment and Material.

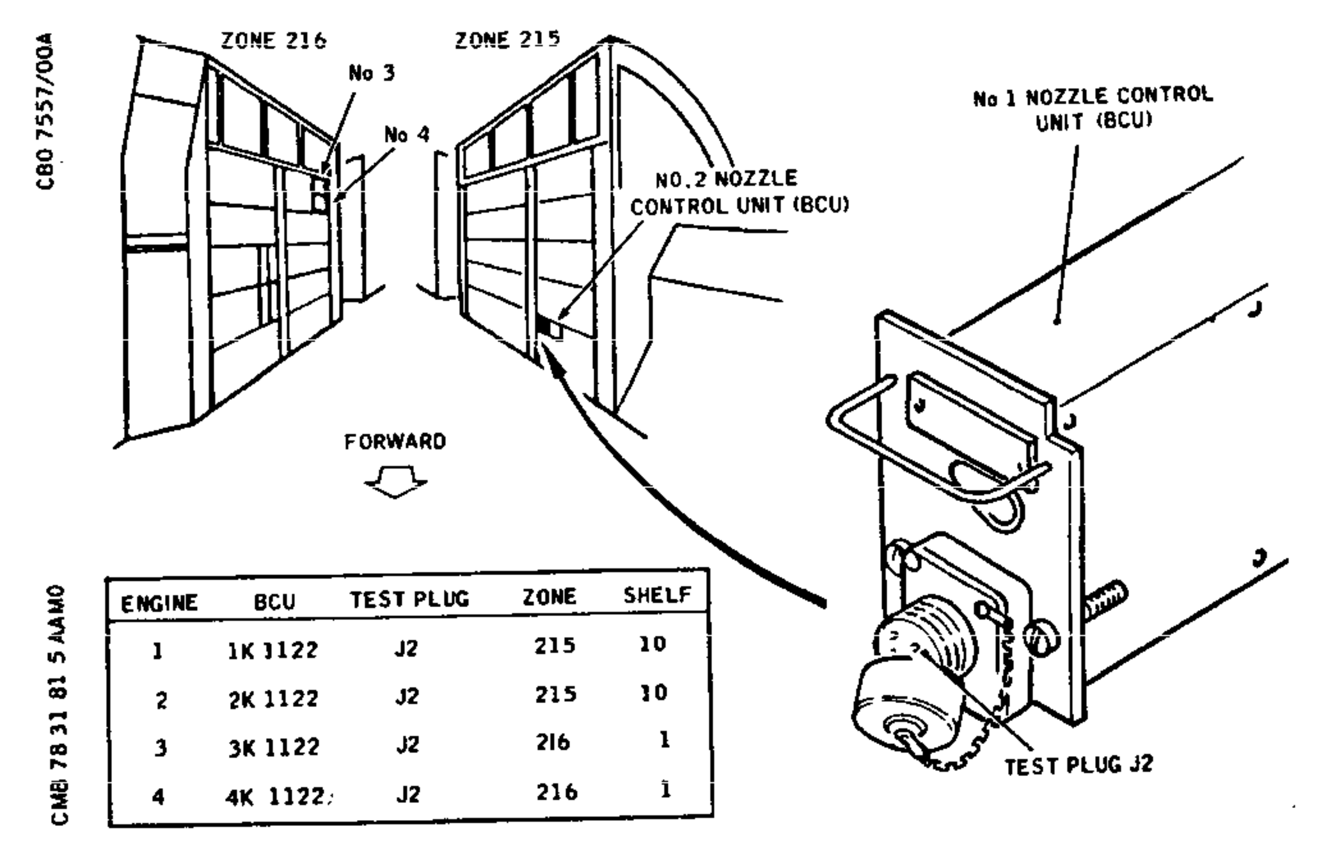
DESCRIPTION	PART NO.
Circuit breaker safety clips	-
NTRC Signal Measurement Box	SC217
Multimeter	-
Extension probes	-

B. Prepare.

(1) Make available electrical ground power (Ref. 24-41-00).

(2) Ensure that a ground air supply is not connected to either of the exhaust system test connections located on each side of the rear engine bay centre wall. Also place a warning placard near the test connections stating that an air supply must not be connected.

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ENGINE	BCU	TEST PLUG	ZONE	SHELF
1	1K 1122	J2	215	10
2	2K 1122	J2	215	10
3	3K 1122	J2	216	1
4	4K 1122	J2	216	1

Bucket Control Unit - Test Plug
Figure 501

(3) Check that the landing gear weight switches are in the ground condition.

(4) Ensure that the No.1 throttle lever is set to idle. Move the reverse thrust lever against the reverse thrust baulk.

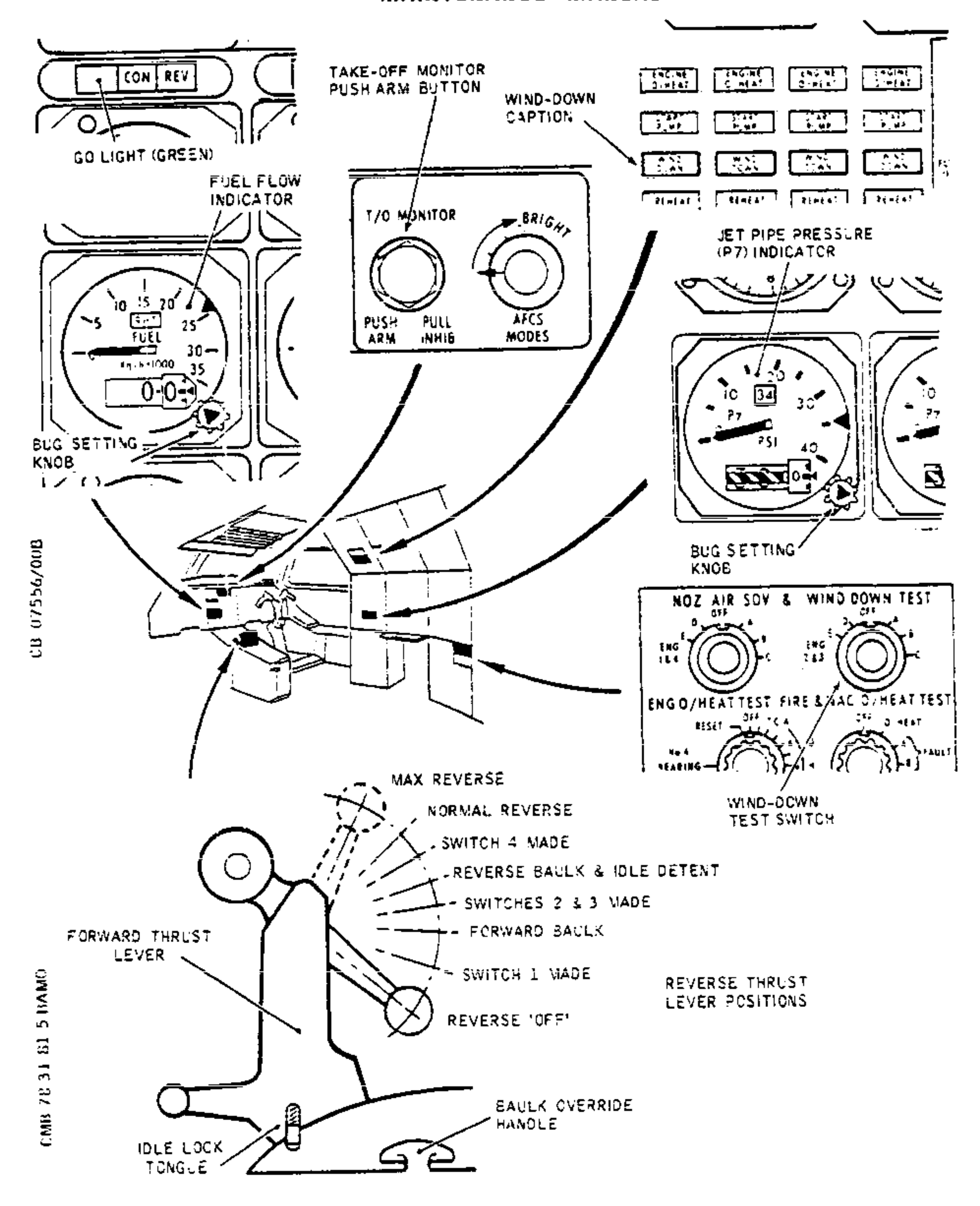
C. Test, Following Change of Throttle Lever or Switch Pack Mounting.

(1) Locate and remove the cover from the forward racking and identify the NOZZLE CONTROL UNIT (Bucket control unit) test plug J2 (Ref. Fig. 501).

(2) Check switch 2 in the No.1 switch pack:

(a) Check for 28 V d.c. between pins R AND C on the test plug.

(3) Return the No.1 reverse thrust lever to 'off':



Reverse Thrust Switch Packs - Testing
Figure 502

R

(a) Move the reverse thrust lever to the forward baulk.

R (b) Check for 0.0V d.c. between pins R and C
R indicating that switch 2 is now open.
now open.

R

(c) Move the reverse thrust lever to 'off'.

R

(4) On the pilots' centre dash panel:

(a) Locate the engine No.1 fuel flow indicator and turn the bug setting knob to maximum.

(b) Locate the engine No.1 jet pipe pressure (P7) indicator and turn the bug setting knob to below ambient pressure.

(c) Locate the take-off monitor. Press the PUSH ARM button and check that the green GO light of the power management lights, located above the engine instruments, is illuminated and the button remains latched in.

(5) At the 3 CM position:

R (a) Locate the WIND DOWN TEST switch and select to position B.

(b) Move the No.1 reverse thrust lever, in the centre console, to above the reverse baulk.

R (c) Select the THROTTLE MASTER switch to MAIN or
R ALTERN.

R (d) Check that the engine No.1 WIND DOWN caption illuminates (Yellow), and that the TAKE OFF MONITOR button is released.

R (6) Lift the BAULK O/RIDE handle, on the right of the
R throttles, and turn it fully clockwise.

R (7) Return the No.1 reverse thrust lever to off and check
R that No.1 WIND DOWN caption goes out.

R (8) Select THROTTLE MASTER switch OFF.

R (9) Turn the BAULK O/RIDE handle fully counter clock-
R wise and allow it to drop into the slot in the
R handle guide. Check that the handle is fully
R seated.

(10) Turn the fuel flow and P7 bugs to their previous settings.

(11) Select WIND DOWN TEST switch OFF.

D. Test 2, Alternative to Test 1 using Signal Measurement Box.

(1) Test as in 78-36-01 Adjustment/Test.

(2) Continue as Test 1, para.2C operations (4) to (10).

E. Conclusion.

(1) Replace and secure the flight compartment racking cover.

(2) Remove the Warning placard from the test connection.

(3) If not required for other servicing, switch off electrical power supplies as detailed in 24-41-00.

(4) Remove the safety clips and reset the circuit breakers previously tripped.

3. Switch Pack - Installation Test 3

A. Prepare

(1) Trip No.1 BCU supply circuit breaker and fit a safety clip:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENG 1 BUCKET CONT UNIT SUP	14-215	1K1132	E12
ENG 2 BUCKET CONT UNIT SUP	13-215	2K1132	G14
ENG 3 BUCKET CONT UNIT SUP	13-216	3K1132	C6
ENG 4 BUCKET CONT UNIT SUP	14-216	4K1132	C6

(2) Ensure that a ground air supply is not connected to either of the exhaust system test connection located on each side of the rear engine bay centre wall. Place a warning placard near the test connections

stating that an air supply must not be connected.

(3) Locate and remove No.1 BCU from the racking, Ref.78-31-85, Removal/Installation.

(4) Make available electrical ground power supplies (Ref.24-41-00).

(5) Ensure that No.1 throttle lever is set to idle. Move the reverse thrust lever against the reverse thrust baulk.

B. Test Following Change of Switch Pack

(1) Using a multimeter and extension probes check switches 2 and 3 in No.1 switch pack at BCU DPX connector K1122A.

(a) Check for earth potential at Pin 2.

(b) Check for 28V d.c. at Pin 3.

(c) Return No.1 reverse thrust lever to the forward baulk position.

(d) Check for 0.0V d.c. at Pin 3.

(e) Check for loss of earth potential at Pin 2.

(f) Move the reverse thrust lever to off.

(2) Continue as Test 1, para 2C, operations (4) to (10).

4. Switch Pack - Adjustment

A. Equipment and Material.

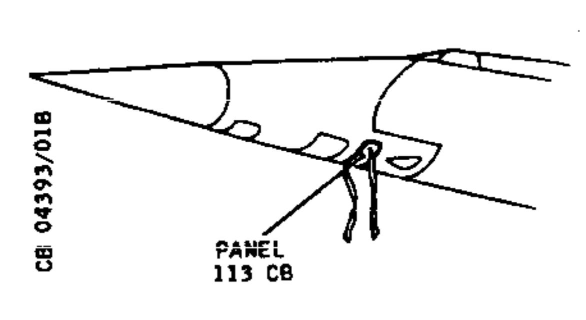
DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Micrometer depth gauge	-
Corrosion resistant steel wire 0.028 in (0.71 mm) dia	-

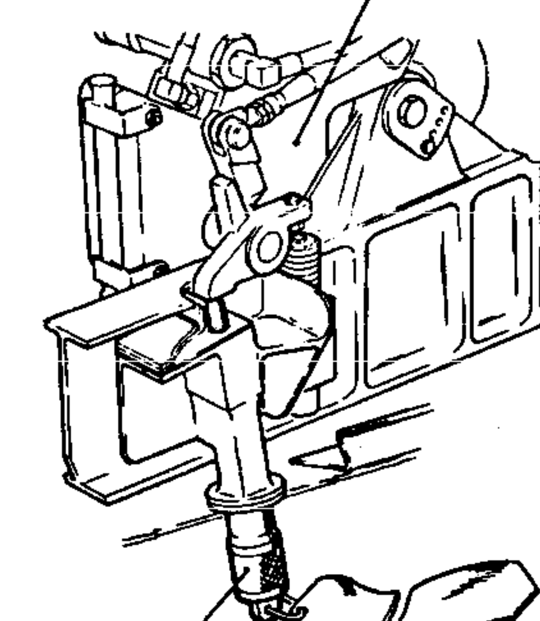
B. Prepare (Ref. Fig.503 and 504).

(1) Trip the engine No.1 circuit breakers and fit safety clips.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
	CHART STOWAGE LTS SUP	15-216	L237	D12
	NOSE 7 1/2 deg. CONT	1-213	M12	Q16
	NOSE/VISOR STBY LOWER SUP	1-213	M13	Q17
	AT SYS 1 SUP	13-215	1C179	C 6
	AT SYNCHRO SYS 1 SUP	13-215	1C181	D 5
	AT 1 CONT	1-213	1C180	Q12
	AFCS 1 CONT	1-213	1C19	Q14
R	AT SYS 2 SUP	13-216	2C179	D16
	AT SYNCHRO SYS 2 SUP	13-216	2C181	B17
	AT 2 CONT	5-213	2C180	A14
	AFCS 2 CONT	5-213	2C19	A12
R				
R	ENG 1			
R	MAIN THROT CONT	3-213	1K3	A 1
	ALT THROT CONT	15-216	1K4	E 8
	REV THRUST CONT	3-213	1K331	D 1
	REHEAT CONT	15-216	1K1542	E 9
	PP MTG LTS SUP	5-213	1E461	D 1
	RATING CONT	3-213	1K8	C 3
	ENG 2			
	MAIN THROT CONT	1-213	2K3	A 3
	ALT THROT CONT	15-215	2K4	F15
	REV THRUST CONT	1-213	2K331	B 5
	REHEAT CONT	15-215	2K1542	D15
	PP MTG LTS SUP	1-213	2E461	E 3
	RATING CONT	1-213	2K8	E 8
	ENG 3			
	MAIN THROT CONT	1-213	3K3	A 4
	ALT THROT CONT	15-215	3K4	F16
	REV THRUST CONT	1-213	3K331	B 6
	REHEAT CONT	15-215	3K1542	D16
	PP MTG LTS SUP	1-213	3E461	E 4
	RATING CONT	1-213	3K8	E 2

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENG 4			
MAIN THROT CONT	3-213	4K3	A 2
ALT THROT CONT	15-216	4K4	F 9
REV THRUST CONT	3-213	4K331	D 2
REHEAT CONT	15-216	4K1542	E10
PP MTG LTS SUP	5-213	4E461	D 2
RATING CONT	3-213	4K8	C 4





CMB 78 31 81 5 CAMO

Droop Nose Locking Pins
Figure 503

NOTE: To improve access it may be necessary to remove the co-pilots' seat (25-11-21, Removal/Installation)

(2) Remove the centre console aft left-hand side panel:

(a) Release the screws securing the panel.

(b) Disconnect the electrical plug for the pilots' floor illumination at the receptacle indentified U2026 on the panel.

(c) Remove the panel.

(3) Remove the droop nose emergency lever (Ref. Fig. 501):

NOTE: This can be done with the nose either up or down.

R (a) If the nose is up fit pins (2) in the droop nose uplocks.

NOTE: No pin is required if the nose is down.

(b) Using the ring pull the release pin outwards at the aft end of the droop nose emergency lever.

(c) Reach through the centre console from the left-hand side and depress the spring-loaded pin on the forward end of the droop nose emergency lever; remove the lever.

(4) Remove the centre console aft right-hand side panel in a manner similar to that described for the left-hand; the electrical plug identification is U2025.

(5) Remove the screws securing the check list stowage: remove the stowage.

(6) Remove the screws securing the crate; hinge back the crate.

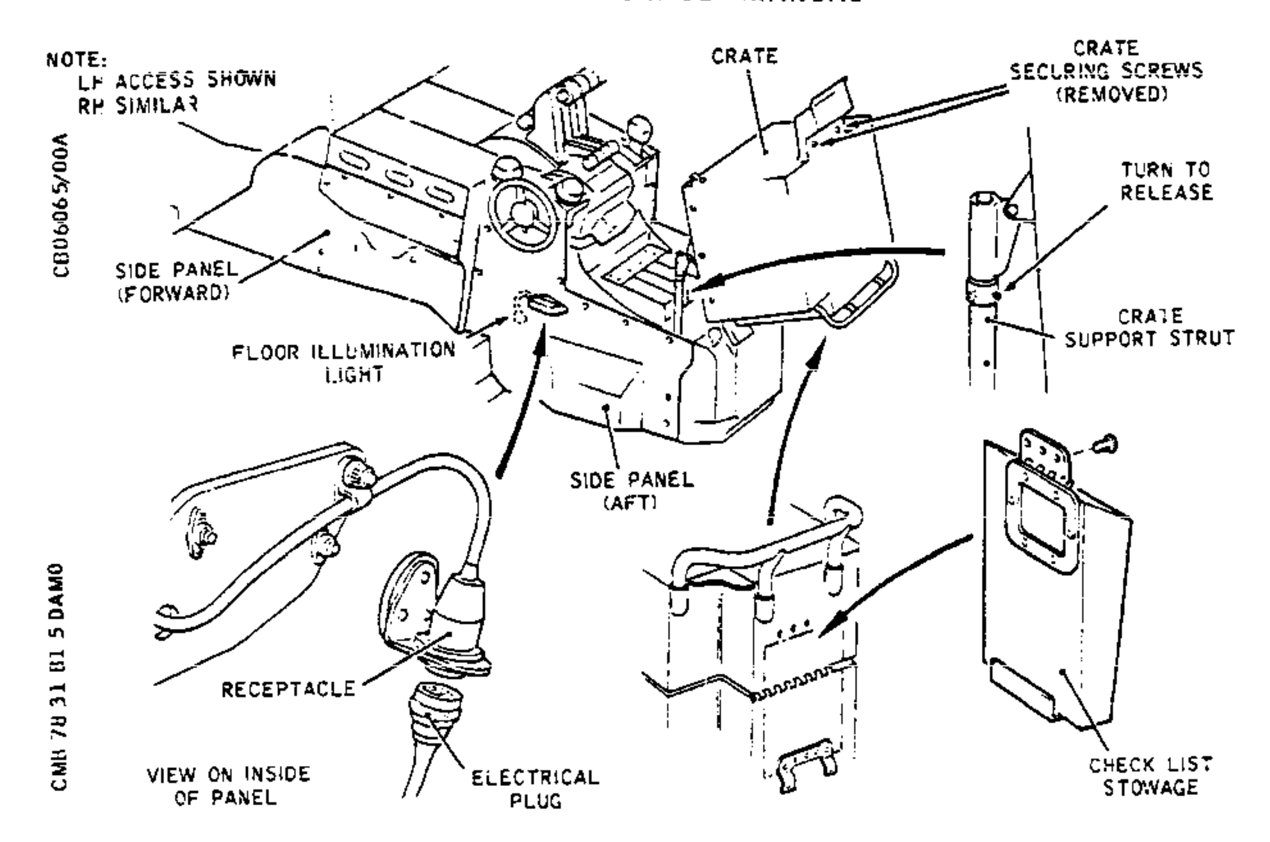
(7) Unscrew the knurled nuts and extract the four throttle transmitters.

C. Check and Adjust (Ref. Fig. 505).

(1) Check the throttle switch pack:

(a) Remove the locking wire and release the two captive bolts securing each reverse thrust switch pack. Move the switch packs rearwards; do not disturb the electrical connections.

(b) Check that the No. 1 throttle lever is at 'idle'



Centre Console - Access
Figure 504

R

and the reverse thrust lever is set to reverse thrust 'off'.

(c) Using a micrometer depth gauge measure the distance between the cam face on the No. 1 throttle lever and the rear face of the spacers on the No. 1 switch pack mounting bracket. This should be between 1.852 and 1.848 in (47.041 and 46.939 mm).

NOTE: In practice the micrometer is moved slightly up or down until it is located on the highpoint of the cam.

(d) If necessary, remove the screws securing the spacers to the rear face of the mounting bracket and grind the spacer until these dimensions are achieved. When satisfactory, secure the spacers to the bracket and tighten the screws.

(e) Repeat operations (b) to (d) inclusive for each

Reverse Thrust Switch Packs - Testing
Figure 505

throttle switch pack.

(f) Refit each switch pack to the mounting bracket and torque tighten the two captive bolts securing each pack to between 25 and 30 lbf in (0.28-0.34 mdaN). Wire lock the bolt heads in two groups of four.

(2) Test each reverse thrust throttle switch pack (Ref. para.2.).

D. Conclusion.

(1) Install the four throttle transmitters (Ref.76-11-12, Removal/Installation).

(2) Check that the area is clean, release the locking struts, and hinge forward the crate. Insert the two securing screws and torque load them to between 70 and 80 lbf in (0.78 and 0.89 mdaN).

(3) Engage the check list stowage with the rear of the crate, fit and tighten the securing screws.

(4) Replace the centre console aft right-hand side panel:

(a) Check the seals for damage and security.

(b) Loosely engage the panel.

(c) Connect the pilots' floor illumination at the receptacle identified U2025 on the panel.

(d) Torque tighten the panel screws to between 40 and 45 lbf in (0.44 and 0.51 mdaN).

(5) Fit the droop nose emergency release lever on the right-hand side of the centre console and insert the release pin.

(6) Secure the centre console aft left-hand side panel in a manner similar to that described for the right-hand panel. The electrical plug is identifed U2026.

(7) If necessary, replace the co-pilots' seat (Ref. 25-11-21, Removal/Installation).

(8) Remove the locking pins (2) from the droop nose.

(9) Remove the safety clips and reset the circuit breakers previously tripped.

(10) Check that the pilots' floor illumination is satisfactory.

(11) Carry out an operational test for freedom of movement of the throttle levers (Ref.76-11-00, Adjustment/Test).

REVERSE THRUST THROTTLE SWITCH PACKS - APPROVED REPAIRS

1. General

The four reverse thrust throttle switch packs are located below and aft of the throttle lever quadrants in the centre console. The approved repairs to each pack are the changing of any of the switches within the pack after it has been removed from the console. Four switches are fitted in each pack and are located by identification plates on the cover. The repair procedure is similar for all four switches.

2. Replacement of Switch Assembly

A. Equipment and Materials

DESCRIPTION	PART NO.
250v Insulation Tester	-
Vernier Height Gauge	-
Surface plate	-
Vee blocks and clamps	-
Test circuit	-
Identification sleeves	BAS 7432 (M002-02)
Bostik 772 (Ref. 20-30-00, No.335)	-
Corrosion resistant steel wire 0.28 in (0.71 mm)	DTD161 or DTD189
Methyl-ethyl-keytone (MEK)	(Ref.20-30-00 No.470)
R R Torque spanner 0-10 lbf in (0.113 mdaN) range	-

B. Preparation

(1) Remove the appropriate switch pack from the centre console (Ref. 78-31-81, Removal/Installation).

C. Removal (Ref. Fig. 801)

(1) Remove and discard the locking wire from the switch pack cover retaining screws. Remove the screws and washers.

(2) Remove the cover from the switch pack body, threading all four sets of switch leads through the grommets in the cover, to gain access to the defective switch assembly.

NOTE: The rubber seal, shown detached, is bonded to the switch pack body.

(3) Remove the nut, washers and bolt from the upper fixing point of the defective switch assembly.

(4) Remove the locknut, washer and eccentric bush from the lower fixing point of the defective switch assembly. Remove the switch assembly, complete with the leads (carefully thread the leads through the grommet in the cover).

D. Preparation of Replacement Switch Assembly

(1) Check the replacement switch assembly for the correct Part No. and examine it for cleanliness and freedom from damage.

(2) Fit identification sleeves to the switch leads, two to each lead, to identify switch number and lead letter.

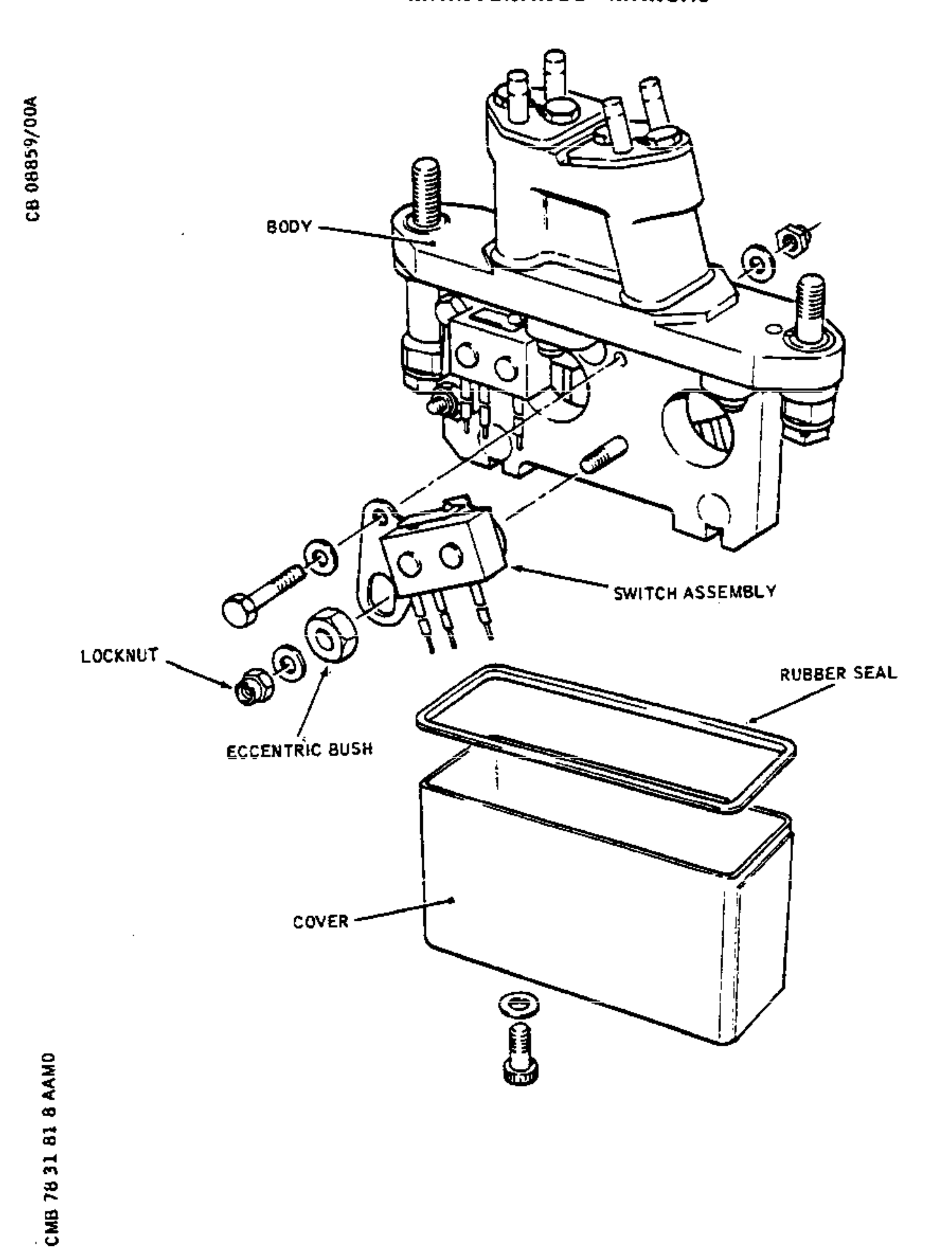
E. Installation

(1) Position the replacement switch assembly in the switch pack and secure it with the bolt, washers
R and nut to the upper fixing point. Torque-load to
R 6.5 lbf in (0.074 mdaN).

(2) Fit the eccentric bush and secure with the washer and
R locknut to the lower fixing point. Torque-load to
R 6.5 lbf in (0.074 mdaN).

(3) Check the condition of the grommet and thread the leads of the replacement switch assembly carefully through it.

(4) Check that the cover rubber seal is in good condition and that it is correctly bonded to the switch pack body.



Reverse Thrust Throttle Switch Pack -
Switch Assembly Replacement
Figure 801

NOTE: The rubber seal is bonded to the switch pack body using Bostik 772.

(5) Refit the cover, threading all four sets of switch leads carefully through the grommets. Secure with the retaining screws and washers.

F. Test (Ref. Fig. 802)

(1) Depress the appropriate switch operating piston manually and check for freedom of movement and operation of the overrun spring. Check that when the switch is slowly released, the piston returns to the fully extended position under spring load.

(2) Set-up the switch pack in vee blocks with clamps on a surface plate so that the mounting face is parallel with the plate.

(3) Connect the switch leads to the test circuit and switch ON; only the red indicating lamp should be illuminated.

(4) Using a vernier height gauge from the surface plate, check dimension C (the switching point maximum, Ref. Table 801). Adjust if necessary (See adjustment Ref. para.G).

(5) Depress the operating piston slowly and check that the switch changes over before dimension A is obtained (Ref. Table 801). The red indicating lamp should extinguish and the green indicating lamp should illuminate.

NOTE: The switch must change over sharply. It must not be possible, by slowly depressing and releasing the operating piston, between the change-over points, either to cause the moving contact to take up a mid position (both lamps in test circuit extinguished), or to creep across the contact gap (indicated by a short period when both lamps are extinguished).

(6) Continue depressing the piston and check that dimension B can be obtained (Ref. Table 801).

(7) Release the piston slowly and check that the switch changes over before dimension C is obtained (Ref. Table 801) and indicated by the red indicating lamp illuminating and the green indicating lamp

extinguishing.

SWITCH NO.	DIMENSION A in(mm)	B in(mm)	C in(mm)
1	1.833 (46.558)	1.608 - 1.618 (40.843 - 41.097)	1.841 (46.761)
2 and 3	1.742 (44.246)	1.576 - 1.586 (40.030 - 40.284)	1.75 (44.450)
4	1.688 (42.875)	1.608 - 1.618 (40.483 - 41.097)	1.696 (43.078)

Piston Operating Dimensions
Table 801

(8) Disconnect and remove the test circuit.

(9) Check that the insulation resistance between the following points is not less than 20 Megohms:

(a) between lead A and lead B.

(b) between operating piston and lead A.

(c) between operating piston and lead B.

G. Adjustment

(1) Remove the switch pack cover retaining screws and washers.

(2) Remove the cover from the switch pack body, threading all four sets of switch leads through the grommets in the cover to give access to the replacement switch assembly.

(3) Loosen the nut on the bolt at the upper fixing point of the switch assembly.

(4) Loosen the locknut at the lower fixing point of the switch assembly.

CB 08861/00A

OPERATING PISTONS

DIM. B DIM. A DIM. C

MOUNTING FACE

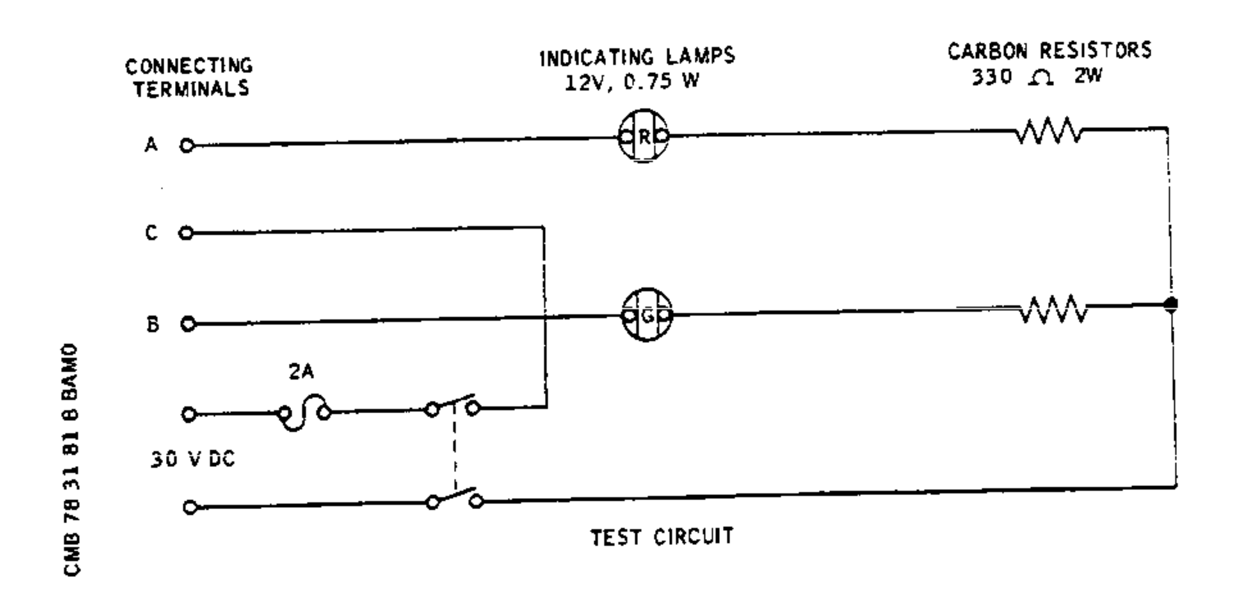
LOCKNUT

ECCENTRIC BUSH

DIMENSION A - SWITCHING POINT (MIN)

DIMENSION C - SWITCHING POINT (MAX)

DIMENSION B - OVERRUN



Switch Setting and Test Circuit
Figure 802

(5) Connect the test circuit to the switch leads (Ref. Fig. 802).

(6) Rotate the eccentric bush at the lower fixing point to adjust the position of the switch assembly to obtain the operating dimensions (Ref. Table 801).

(7) Tighten the locknut at the lower fixing point and
R the nut at the upper fixing point; torque-tighten
R each to 6.5 lbf in (0.074 mdaN).

(8) Recheck the operating dimensions (Ref. Table 801).

(9) Disconnect the test circuit from the switch leads.

(10) Refit the cover, threading all four sets of switch leads carefully through the grommets. Secure with the retaining screws and washers.

H. Conclusion

(1) Remove the switch pack from the measuring equipment.

(2) Wire-lock the switch pack cover screws together.

(3) Refit the switch pack in the console and test (Ref. 78-31-81, Removal/Installation).

THRUST REVERSE LEVER DETENT - ADJUSTMENT/TEST

1. General

The purpose of this topic is to provide a simple mechanical test of the thrust reverse lever movement, with adjustment of the detent spring. The test is given for No.1 engine position and may be repeated for all positions.

2. Operational Test and Adjustment

A. Equipment and Materials

DESCRIPTION	PART NO.
Spring balance 0-10 lbf (0-4.5 kgf)	-
Screwdriver	-

B. Prepare

(1) Check that the aircraft is in the normal ground condition with weight on the landing gear, and that the following circuit breakers are set.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
Engine No.1			
PP MGT LTS SUP	5-213	1E461	D 1
REV BUCKET POSN IND	5-213	1E121	A 3
LH U/C WEIGHT SW 'B' SYS SUP	3-213	G293	B 8
RH U/C WEIGHT SW 'B' SYS SUP	3-213	G294	B 9
Engine No.2			
PP MGT LTS SUP	1-213	2E461	E 3
REV BUCKET POSN IND	1-213	2E121	B 7
LH U/C WEIGHT SW 'A' SYS SUP	1-213	G292	M17
RH U/C WEIGHT SW 'A' SYS SUP	1-213	G295	M18

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
Engine No.3			
PP MGT LTS SUP	1-213	3E461	E 4
REV BUCKET POSN IND	1-213	3E121	B 8
LH U/C WEIGHT SW 'A' SYS SUP	1-213	G292	M17
RH U/C WEIGHT SW 'A' SYS SUP	1-213	G295	M18
Engine No.4			
PP MGT LTS SUP	5-213	4E461	D 2
REV BUCKET POSN IND	5-213	4E121	A 4
LH U/C WEIGHT SW 'B' SYS SUP	3-213	G293	B 8
RH U/C WEIGHT SW 'B' SYS SUP	3-213	G294	B 9

(2) Make available electrical ground power (Ref. 24-41-00, Servicing).

WARNING: CHECK THAT NO AIR SUPPLY IS CONNECTED TO THE BUCKET OPERATING SYSTEM AND THAT WARNING PLACARDS ARE DISPLAYED.

C. Test

(1) Advance No.1 main throttle lever and check that the thrust reverse lever will not move from the off position.

(2) Return the No.l main throttle lever to idle and raise the No.1 thrust reverse lever to the reverse baulk position.

(3) Retract the reverse baulk:

(a) Set the ENG 1 & 4 WIND DOWN TEST selector switch on panel 27-214 to position A.

(b) Check that the blue REV caption on the centre dash panel illuminates.

NOTE: If the thrust reverse lever remains baulked, refer to 71-00-51, Trouble Shooting.

(4) Move No.1 thrust reverse lever to the normal reverse detent position (Ref. Fig. 501) and attach a suitable spring balance.

(5) Check that the force required to override the detent is approximately 9 lbf (4.08 kgf) in the direction of increasing thrust.

NOTE: If the detent pull-out force is suspect, adjust as in Para.2.D.

(6) Raise the thrust reverse lever to the maximum stop position and reset the WIND DOWN TEST selector switch to OFF.

(7) Move the thrust reverse lever forward from the maximum position to the reverse idle detent, then back, to check that the reverse baulk has re-engaged.

(8) Re-select the WIND DOWN TEST selector switch to position A.

(9) Move the thrust reverse lever forward through the reverse idle detent to forward baulk position.

(10) Lift the BAULK O/RIDE handle on the right of the centre console and turn it 90 degrees clockwise.

(11) Move the thrust reverse lever fully forward and down to the off position.

(12) Return the BAULK O/RIDE handle counter clockwise and allow it to drop into the slot in the handle guide. Check that the handle is fully seated.

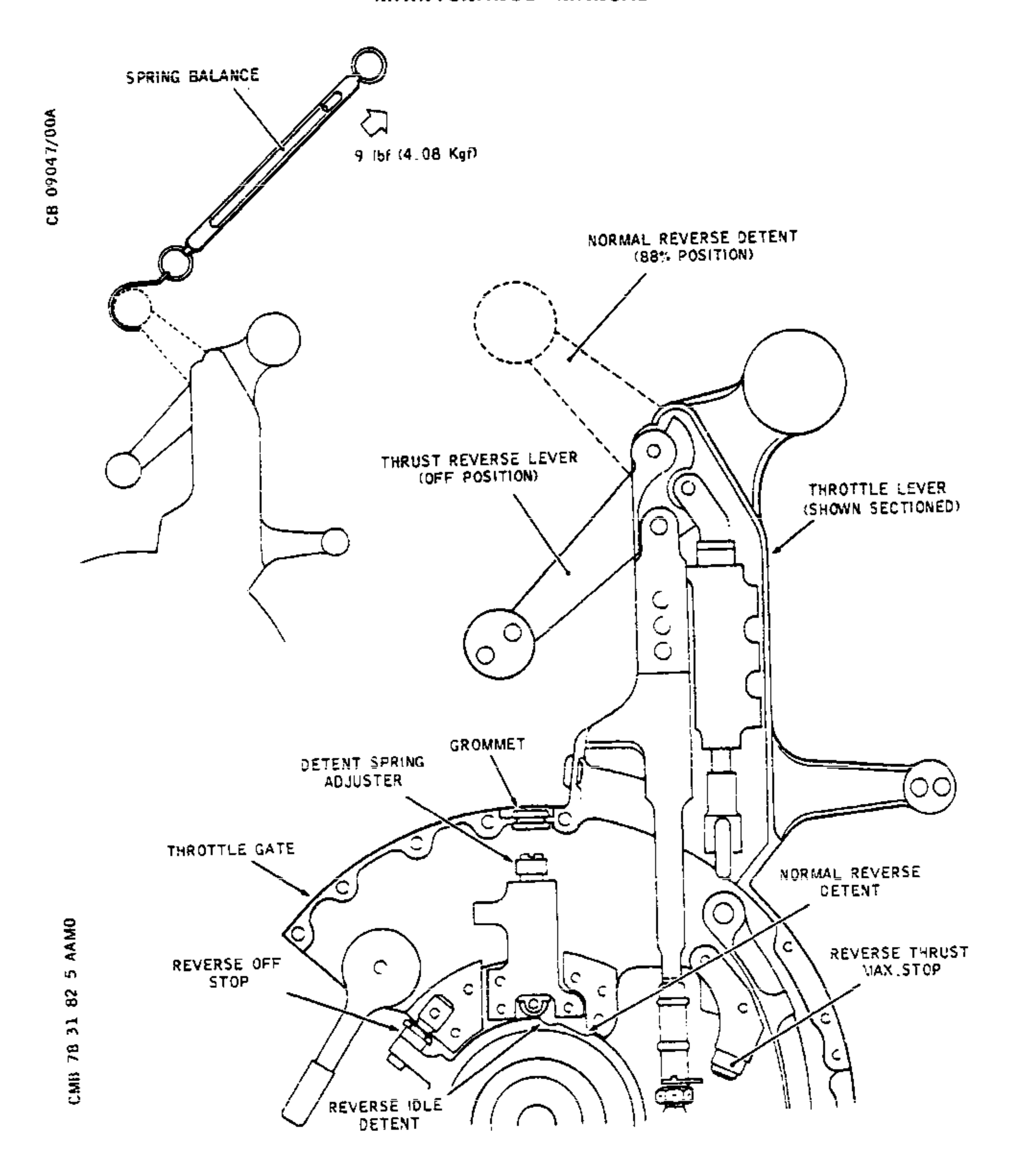
(13) Select the WIND DOWN TEST switch OFF.

D. Adjust Thrust Reverse Detent Spring (Ref. Fig. 501)

(1) Set the main throttle lever fully rearward against the stop and remove the grommet from the gate in front of the lever (Ref. Fig. 501).

(2) Set the ENG 1 & 4 WIND DOWN TEST selector switch to position A and move the thrust reverse lever to the normal reverse detent position.

(3) Attach a spring balance to the thrust reverse lever and exert a pull at right angles to the lever in the direction of increasing thrust. Note the force



Adjustment of Thrust Reverse Detent Spring
Figure 501

required to overcome the detent. Take the mean result of several checks.

(4) Insert a screwdriver through the aperture in the throttle gate and engage the detent spring adjuster. Turn, one click at a time, clockwise to increase the pressure and counter clockwise to decrease the pressure.

(5) Re-check the detent pull-out force on the lever and re-adjust the spring as required to achieve a force of approximately 9 lbf (4.08 kgf).

(6) Replace the grommet in the throttle gate.

(7) Repeat the operational test for all four engine positions and adjust as necessary.

E. Conclusion

(1) Set all thrust reverse levers to the fully forward and down position.

(2) Check that the BAULK O/RIDE handle is down and fully seated.

(3) Switch off and disconnect electrical ground power (Ref. 24-41-00, Servicing).

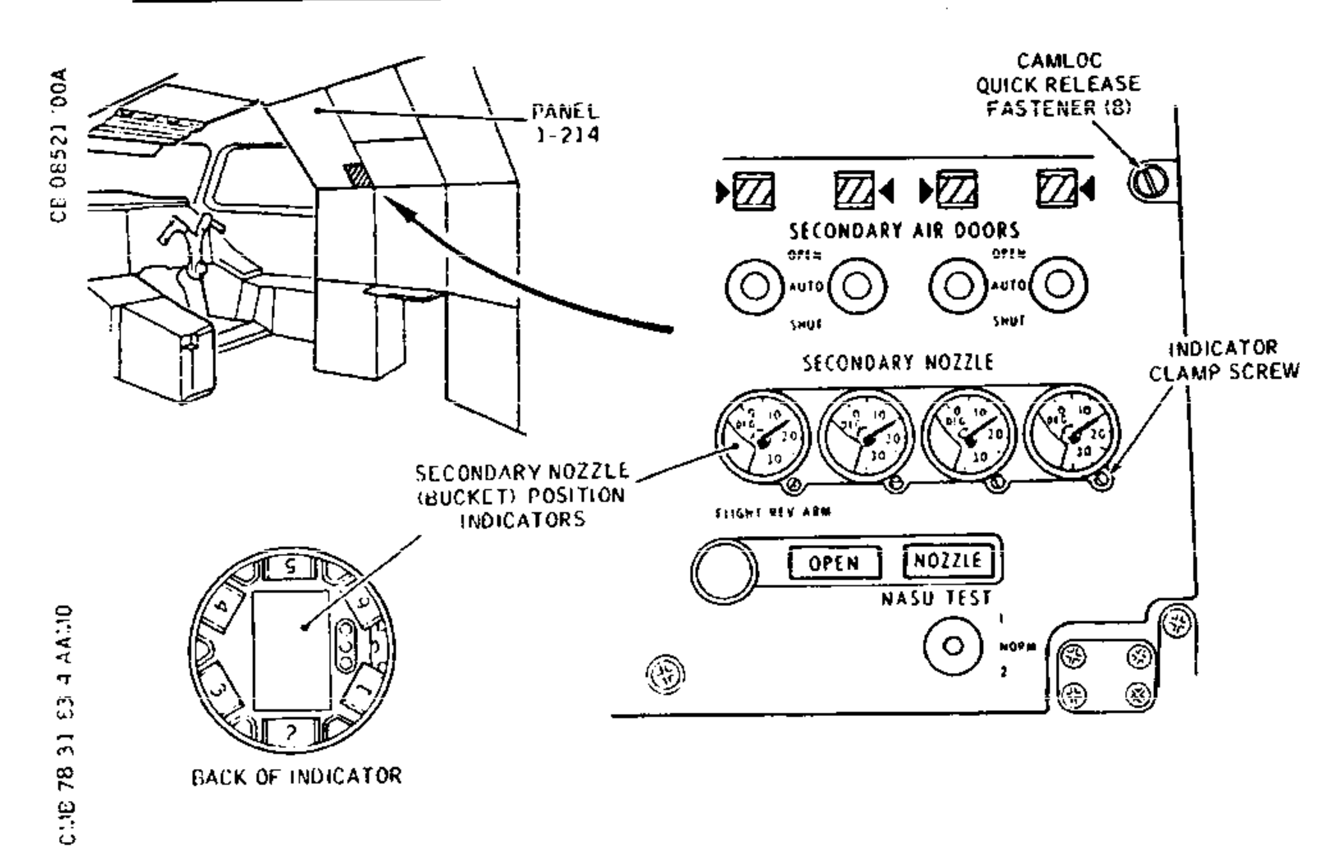
SECONDARY NOZZLE (BUCKET) MODULATED POSITION INDICATOR - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Four secondary nozzle (bucket) modulated position indicators are located in the lower part of panel 1-214 at the 3CM station. The panel is secured in position by Camloc quick-release fasteners and hinges downwards for access to the electrical connections at the rear.

2. Secondary Nozzle (Bucket) Modulated Position Indicator (Ref. Fig. 401)



Secondary Nozzle (Bucket) Modulated
Position Indicator
Figure 401

A. Equipment and Materials

DESCRIPTION	PART NO.
Screwdrivers	-
Circuit breaker safety clips	-

B. Prepare to Remove

(1) Trip the circuit breakers listed below; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
3CM STN INST LTS SUP	13-216	L377	E 7
ENG 1 BUCKET CONT UNIT SUP	14-215	1K1132	E12
ENG 2 BUCKET CONT UNIT SUP	13-215	2K1132	G14
ENG 3 BUCKET CONT UNIT SUP	13-216	3K1132	C 6
ENG 4 BUCKET CONT UNIT SUP	14-216	4K1132	C 6

R (2) Release the eight Camloc fasteners securing panel 1-214 and hinge the panel downward.

C. Remove

(1) Disconnect the electrical connections to the indicator and replace the screws.

(2) Loosen the indicator clamp screw; withdraw the indicator through the front of the panel.

D. Install

(1) Observe the electrical safety precautions.

(2) Insert the indicator through the front of panel 1-214 and secure in position by tightening the indicator clamp screw.

(3) Release the Camloc fasteners and lower the panel.

(4) Attach the electrical connections to terminals 1, 2, 4, 5 and 6 in accordance with the colour code. Terminal 3 is unused.

(5) Refit panel 1-214.

(6) Reset the circuit breakers previously tripped and carry out an operational test on the indicator (Ref.78-31-83, Adjustment/Test).

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SECONDARY NOZZLE (BUCKET) MODULATED POSITION INDICATOR - ADJUSTMENT/TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The secondary nozzle (bucket) modulated position indicators are located in the lower part of panel 1-214 at the 3CM station.

2. Operational Test

A. Test

(1) With electrical power off, check that the indicator pointers read off the scale at the low end.

(2) Make available electrical ground power as detailed in 21-41-00.

(3) Check that with power on and the circuit breakers set, the indicators show a reading.

B. Conclusion

(1) Switch off and disconnect electrical ground power.

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END OF THIS SECTION

NEXT

NOZZLE ANGLE SCHEDULING UNIT - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The nozzle angle scheduling units (NASU's), No. 1 for engines 1 and 4 and No. 2 for engines 2 and 3 are each housed in a 3/8 ATR short case. They are located in the flight compartment electrical racks on shelves 10-215 and 1-216 respectively.

2. Nozzle Angle Scheduling Unit

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

B. Prepare to Remove NASU

(1) Electrically isolate the NASU by tripping the appropriate circuit breakers. Fit circuit breaker safety clips.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
R	NASU No. 1			
R	NASU 1 SUP	14-216	K1136	A 7
R	NASU 1 PROG CONT	15-216	K1134	C 9
R	'E' SCHD SUP 1	1-213	K34	E 7
R	NASU TEST SUP	15-215	K1133	E17
R	ENG 1 RATING CONT	3-213	1K8	C 3
R	ENG 2 RATING CONT	1-213	2K8	E 8
R	ENG 3 RATING CONT	1-213	3K8	E 2
R	ENG 4 RATING CONT	3-213	4K8	C 4
R	ENG 1 REHEAT CONT	15-216	1K1542	E 9
R	ENG 2 REHEAT CONT	15-215	2K1542	D15
R	ENG 3 REHEAT CONT	15-215	3K1542	D16
R	ENG 4 REHEAT CONT	15-216	4K1542	E10

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SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
R NASU No. 2			
R NASU 2 SUP	13-215	K1137	B13
R NASU 2 PROG CONT	15-215	K1135	F17
R 'E' SCHD SUP 2	3-213	K35	B 3
R NASU TEST SUP	15-215	K1133	E17
R ENG 1 RATING CONT	3-213	1K8	C 3
R ENG 2 RATING CONT	1-213	2K8	E 8
R ENG 3 RATING CONT	1-213	3K8	E 2
R ENG 4 RATING CONT	3-213	4K8	C 4
R ENG 1 REHEAT CONT	15-216	1K1542	E 9
R ENG 2 REHEAT CONT	15-215	2K1542	D15
R ENG 3 REHEAT CONT	15-215	3K1542	D16
R ENG 4 REHEAT CONT	15-216	4K1542	E10
R			

(2) Remove the cover from the appropriate racking and identify the NASU to be removed.

C. Remove NASU

(1) Release the two hold-down pin assemblies.

(2) Grasp the handle of the NASU and carefully withdraw it from the backplate connector; remove the NASU from the shelf.

D. Install NASU

(1) Comply with the electrical safety precautions.

(2) Ensure that the mating surfaces of the backplate connector are clean and undamaged.

(3) Position the NASU on the shelf runners then carefully slide it rearwards, engaging the backplate connector.

(4) Engage the two hold-down pin assemblies with the claws on the front of the NASU and tighten them, ensuring that the unit is bonded in accordance with 20-27-11.

E. Conclusion

(1) Remove the safety clips and reset the circuit breakers tripped previously.

(2) Refit and secure the racking cover.

(3) Carry out the Operational test in 78-31-84, Adjustment/Test.

R NOZZLE ANGLE SCHEDULING UNIT (NASU) - ADJUSTMENT/TEST

WARNING: (1) OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS IN 24-00-00.

(2) BEFORE CONNECTING ANY AIR SOURCE TO THE GROUND TEST CONNECTION, ENSURE THAT THE TWO BUCKET SYSTEMS OF THE TWIN SECONDARY NOZZLE ARE CLEAR OF PERSONNEL AND EQUIPMENT. PLACE TEST WARNING SIGNS.

1. General

R R The test procedures comprise Operational and Functional Tests.

R R R R R The Operational Tests are arranged in two groups to cover the NASU comparators and switching and the HI 'E' Schedule signal switching. The tests are given for No.1 and No.2 engine positions and as the NASU control is arranged in inboard and outboard pairs, this effectively covers both NASU's.

R R R R The Functional Test are carried out with a test set, which is connected to the NASU and bucket control unit (BCU) front connections. In this application the test set can be used in any one of the following four modes:

R R (1) SELF TEST - self interrogation of the test set before use.

R R (2) RUN - an automatic sequence of 33 tests, which stops when a fault condition is encountered.

R R (3) SINGLE TEST - the same test sequence is progressed or stepped manually by momentarily depressing the GO caption.

R R R R R (4) SIM (Simulated Mach Voltage) - manually controlled simulated mach voltage is supplied to the NASU by operation of the ADC/SIM potentiometer. When the SIM mode is selected, the RUN/SINGLE TEST/SELF TEST switch functions are inhibited.

R R R R R In the Self Test, Run and Single Test procedures the term 'momentarily depress' is used for operation of the GO caption. If the GO caption is held depressed, the selected test sequence will cycle through, overriding all failed test positions and inhibiting the operation of the FAIL TEST caption.

R R R Power supplies for the test set are obtained through the NASU on test. This is always referred to in the following instructions as NASU 'A'.

Whenever electrical power is interrupted or switched on to the test set, the TEST NO. display will show "00" and the GO lamp will be illuminated, indicating that the start conditions are satisfied irrespective of the test set switch positions. The required test mode must be selected and initiated as described. Any test sequence can be interrupted and immediately returned to the static "00" display position by switching the test set power control switch "OFF", then "ON".

During SIM testing, or in any other mode, a digital voltmeter can be used at the test set ADC O/P and BCU I/P sockets to monitor the simulated ADC output from the test set and the NASU's BCU input signal at levels appearing at the NASU front connector.

2. Operational Test - Comparator and Alpha Signal Switching (Ref. Fig. 501)

A. Equipment and Materials

DESCRIPTION	PART NO.
Ground Air Supply of 43 psig (3 bar) not to fall below 36 psig (2.5 bar)	-

B. Prepare

(1) Make available electrical ground power (Ref.24-41-00).

(2) Connect a ground air supply to No.1 engine bay test connection (Ref.78-00-00).

(3) On panel 1-214 at the 3cm station, check:

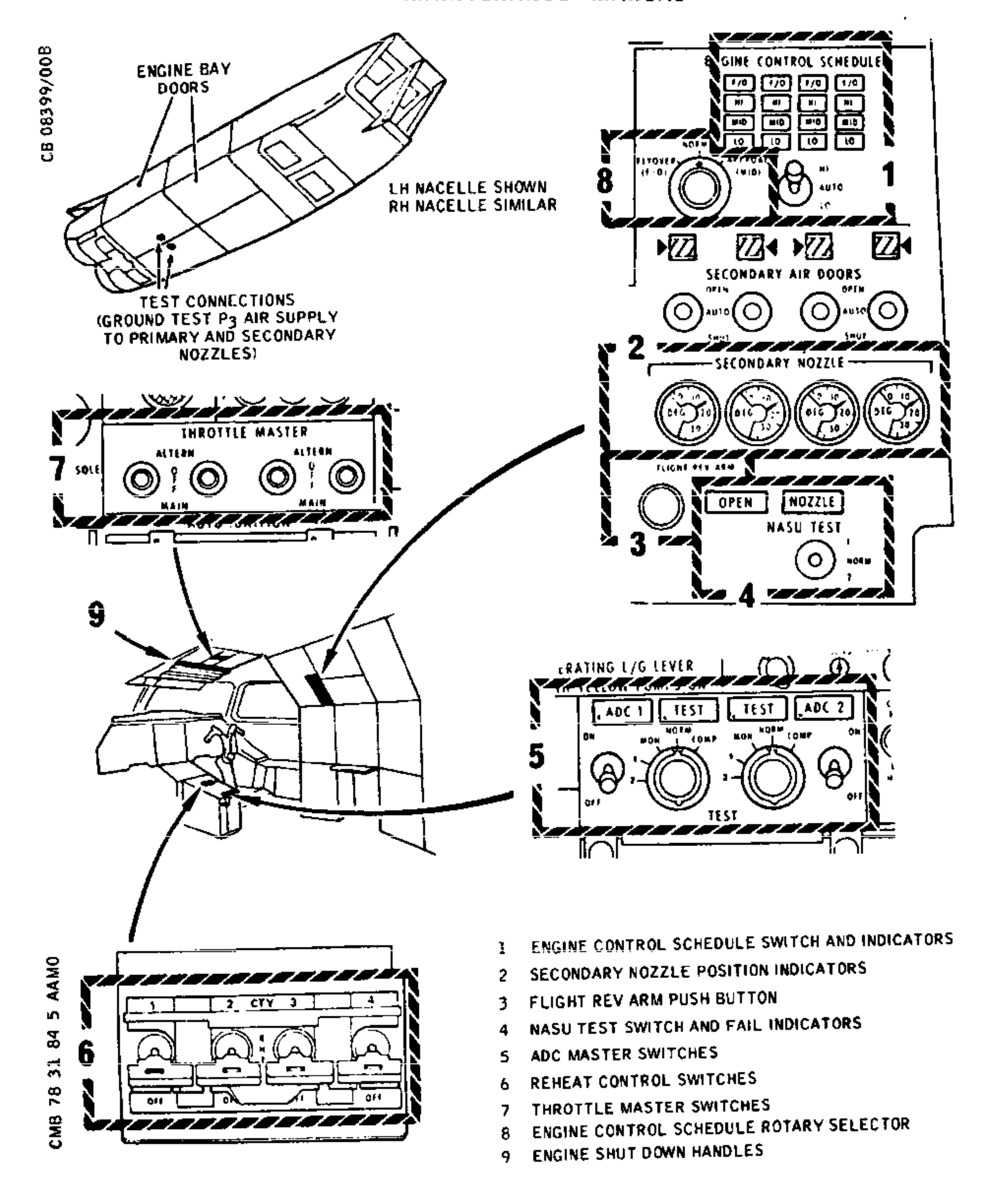
(a) FLIGHT REV ARM push button is out.

(b) OPEN and NOZZLE captions are extinguished.

C. Test

WARNING: KEEP CLEAR OF THE SECONDARY NOZZLES.

(1) Check that the circuit breakers listed below are set.



1 ENGINE CONTROL SCHEDULE SWITCH AND INDICATORS
2 SECONDARY NOZZLE POSITION INDICATORS
3 FLIGHT REV ARM PUSH BUTTON
4 NASU TEST SWITCH AND FAIL INDICATORS
5 ADC MASTER SWITCHES
6 REHEAT CONTROL SWITCHES
7 THROTTLE MASTER SWITCHES
8 ENGINE CONTROL SCHEDULE ROTARY SELECTOR
9 ENGINE SHUT DOWN HANDLES

Nozzle Angle Scheduling Unit - Adjustment/Test
Figure 501

R

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
NASU 1 SUP	14-216	K1136	A 7
NASU 2 SUP	13-215	K1137	B13
NASU TEST SUP	15-215	K1133	E17
ADC 1 115V SUP	2-213	1F73	F 3
ADC 2 115V SUP	13-216	2F73	F15
ADC 1 28V SUP	1-213	1F74	P12
ADC 2 28V SUP	5-213	2F74	F12
LH U/C WEIGHT SW 'A' SYS SUP	1-213	G292	M17
RH U/C WEIGHT SW 'A' SYS SUP	1-213	G295	M18
LH U/C WEIGHT SW 'B' SYS SUP	3-213	G293	B 8
RH U/C WEIGHT SW 'B' SYS SUP	3-213	G294	B 9
ENG 1 BUCKET CONT UNIT SUP	14-215	1K1132	E12
ENG 2 BUCKET CONT UNIT SUP	13-215	2K1132	G14

(2) Select ADC1 and ADC2 master switches "ON" (Ref. 34-11-00).

(3) Select ADC1 and ADC2 TEST switches "NORM".

(4) Check that ADC1, ADC2 and both TEST captions are extinguished.

(5) Check that the NOZZLE fail caption is extinguished.

(6) Switch on air supply.

(7) Select NASU TEST switch to "1" and back to "NORM".

(8) Check that the NOZZLE fail caption illuminates and goes out in step with the above TEST switching, and that the No. 1 secondary nozzle position indicator remains at 21° throughout operation (7).

(9) Disconnect the test air supply.

(10) Connect the air supply to No 2 engine bay test connection.

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(11) Select NASU TEST switch to 2 and back to NORM.

(12) Check that the NOZZLE fail caption illuminates and goes out in step with the TEST switching, and that the No. 2 secondary nozzle position indicator remains
R at 21° throughout operation (11).

(13) Switch off and disconnect the test air supply and electrical ground power (Ref.24-41-00).

3. Operational Test of HI 'E' Schedule Signal Switching (Ref. Fig. 501)

A. Equipment and Materials

DESCRIPTION	PART NO.
R Circuit breaker safety clips	-

B. Prepare

(1) Make available electrical ground power (Ref.24-41-00).

R (2) Check that ADC 1 and ADC 2 master switches are
R selected "ON" (Ref. 34-11-00).

(3) On panel 1-214 at the 3CM station, check:

(a) FLIGHT REV ARM push button is out.

(b) OPEN and NOZZLE captions are extinguished.

C. Test

WARNING: KEEP CLEAR OF THE SECONDARY NOZZLES.

(1) Trip the circuit breakers listed below and fit safety clips.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
R	NASU 1 PROG CONT	15-216	K1134	C 9
R	NASU 2 PROG CONT	15-215	K1134	F17
R	ENG 1 REHEAT AMP SUP	14-215	1K1541	C12
R	ENG 2 REHEAT AMP SUP	13-215	2K1541	B14

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENG 1 SEC AIR DOOR MTR SUP	2-213	1K247	C10
ENG 2 SEC AIR DOOR MTR SUP	2-213	2K247	F10
ENG 3 SEC AIR DOOR MTR SUP	4-213	3K247	A19
ENG 4 SEC AIR DOOR MTR SUP	4-213	4K247	F19

(2) Check that the circuit breakers listed below are set in addition to those listed in para 2C (1).

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENG 1 MAIN THROT SUP	2-213	1K1	F12
ENG 2 MAIN THROT SUP	2-213	2K1	C12
ENG 1 MAIN THROT CONT	3-213	1K3	A 1
ENG 2 MAIN THROT CONT	1-213	2K3	A 3
ENG 1 MAIN THROT FAIL IND	1-213	1K5	A 1
ENG 2 MAIN THROT FAIL IND	3-213	2K5	A 3
'E' SCHD SUP 1	1-213	K34	E 7
'E' SCHD SUP 2	3-213	K35	B 3
ENG 1 REHEAT CONT	15-216	1K1542	E 9
ENG 2 REHEAT CONT	15-215	2K1542	D15

(3) Select ADC1 and ADC2 master switches "ON".

(4) Select ADC1 and ADC2 TEST switches "NORM".

(5) Check that ADC1, ADC2 and both TEST captions are extinguished.

(6) Check that the NOZZLE fail caption is extinguished.

(7) Select No.1 and No.2 THROTTLE MASTER switches "MAIN".

(8) Select ENGINE CONTROL SCHEDULE switch "AUTO".

(9) Select No.1 and No.2 REHEAT switches "OFF".

(10) Check that No.1 and No.2 ENGINE CONTROL SCHEDULE captions show "LO".

(11) Select ADC1 and ADC2 TEST switches "TEST 1".

(12) Check that No.1 and No.2 ENGINE CONTROL SCHEDULE captions show "HI".

(13) Select NASU TEST switch "1", then "2" and return to "NORM".

(14) Check that No.1 and No.2 ENGINE CONTROL SCHEDULE captions still read "HI".

(15) Select ADC 1 and ADC 2 TEST switches "NORM" and check that the ENGINE CONTROL SCHEDULE caption shows "LO".

4. Functional Test (Ref. Fig. 501, 502 and 503).

NOTE: The test set LED (light emitting diode) display indicates the presence of incoming and outgoing NASU signals (Ref. Table 501). The 'E' Schedule functions of the NASU can be further monitored during testing by selecting 'on line' the appropriate engine control units and observing the flight compartment 'E' Schedule module responses.

Manual modulation of the nozzle can be carried out with the test set in the ADC/SIM mode and the voltage, which is monitored at the BCU I/P sockets, set to the level required before P3 air is applied to the system.

Throughout the following instructions on the use of the test set, the NASU under test is referred to as NASU 'A' and its directly supplied BCU's as BCU 'A' and BCU 'B'. The other NASU is referred to as NASU 'B' (Ref. Fig. 503).

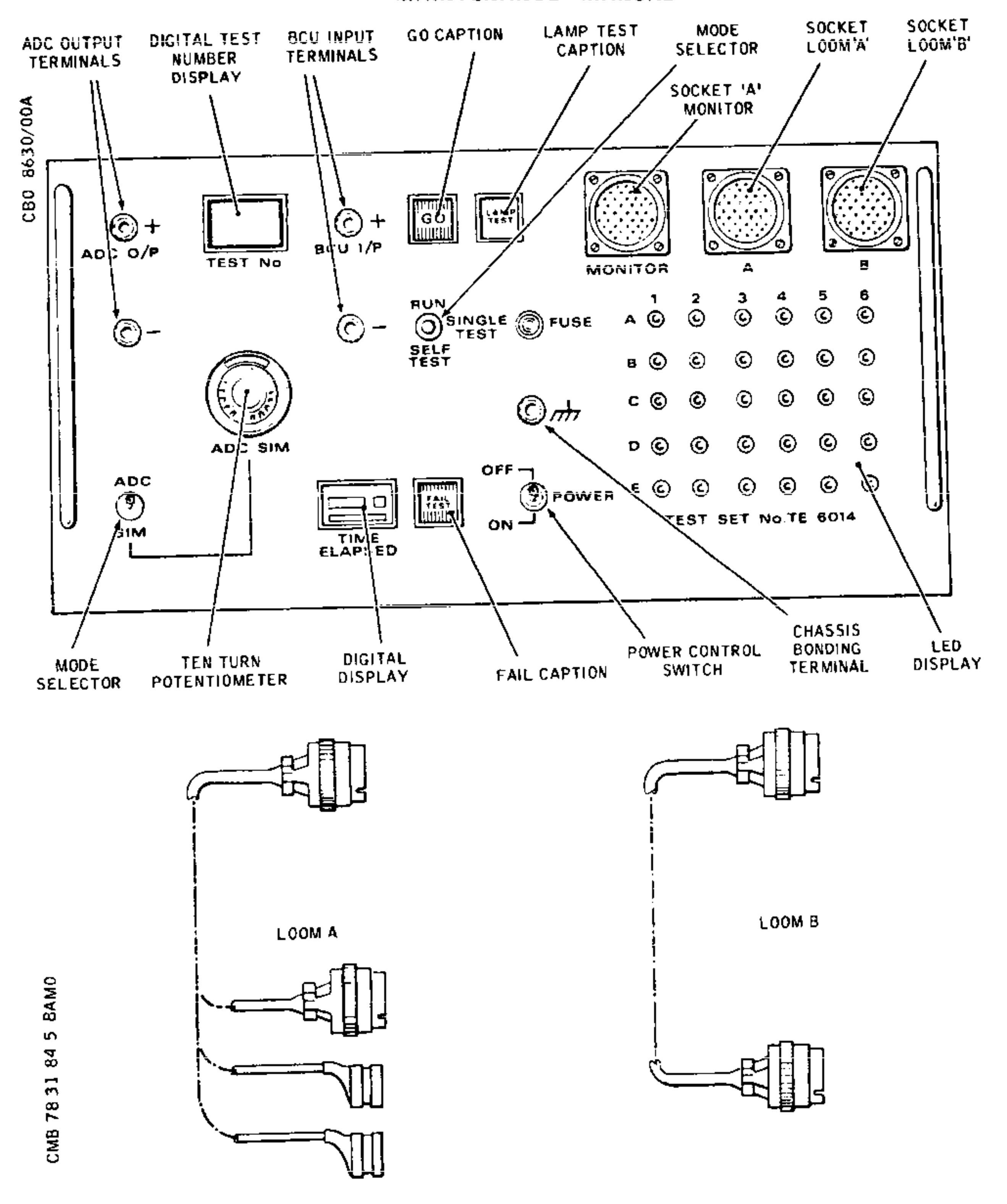
CAUTION: WHEN P3 AIR IS APPLIED TO THE THRUST REVERSE ASSEMBLY DRIVE DO NOT USE THE TEST SET IN THE FOLLOWING MODES, (a) RUN, (b) SINGLE TEST, (c) SELF TEST.

LED	FUNCTION	INDICATION
A1	NASU supply to ADC mach potentiometer.	On for signal present.

LED	FUNCTION	INDICATION
A2	NASU 'A' BCU signal.	On for signal equal to or greater than 3 V d.c.
A3	NASU 'B' BCU signal.	On for signal equal to or greater than 3 V d.c.
A4	ADC and T alpha screens.	On when screens satisfactory.
A5	Not allocated.	
A6	115 V a.c., 400 Hz.	On for supply present.
B1	NASU 'A' flight plug link.	On if link is serviceable.
B2	Maximum/reduced power.	Off for power reduced.
B3	Lift off signal.	On for lift off.
B4	NASU 'B' flight plug link.	On if link is serviceable.
B5	Mach fail signal.	Off for mach fail.
B6	BCU 'A' monitor signal.	On when BCU signal equal to or greater than 3 V d.c.
C1	VCO signal from ADC.	On at less than VCO.
C2	NASU 'A' TEST switch signal.	On when test switch fail signal is present.
C3	NASU 'A' 'E' AUTO supply.	On when ENGINE CONTROL SCHEDULE switch is at "AUTO".
C4	Flyover selection.	On when "FLYOVER" selected.
C5	VCO test signal.	On at less than VCO.
C6	BCU 'B' monitor signal.	On when BCU signal equal to or greater than 3 V d.c.
D1	T alpha reference.	On when T alpha reference signal is present.
D2	Approach selection.	On when "APPROACH" is selected.
D3	ASOV control, NASU 'A'.	On when mach is equal to or greater than 1.2.
D4	NASU fail.	Off for NASU 'A' or NASU 'B' fail
D5	'E' Flyover.	On when 'E' Flyover is obtained.
D6	ASOV control, NASU 'B'.	On when mach is equal to or greater than 1.2.
E1	'E' High.	On when 'E' High is obtained.
E2	'E' Approach.	On when 'E' Approach is obtained.
E3	ASOV control, NASU 'A'.	On when mach is equal to or greater than 1.2.
E4	T alpha signal.	On when ADC T alpha pick-off sig equal to or greater than 3 V d.c.
E5	ADC mach signal.	On when ADC mach pick-off signal equal to or greater than 2 V d.c.
E6	ASOV control, NASU 'B'.	On when mach equal to or greater than 1.2.

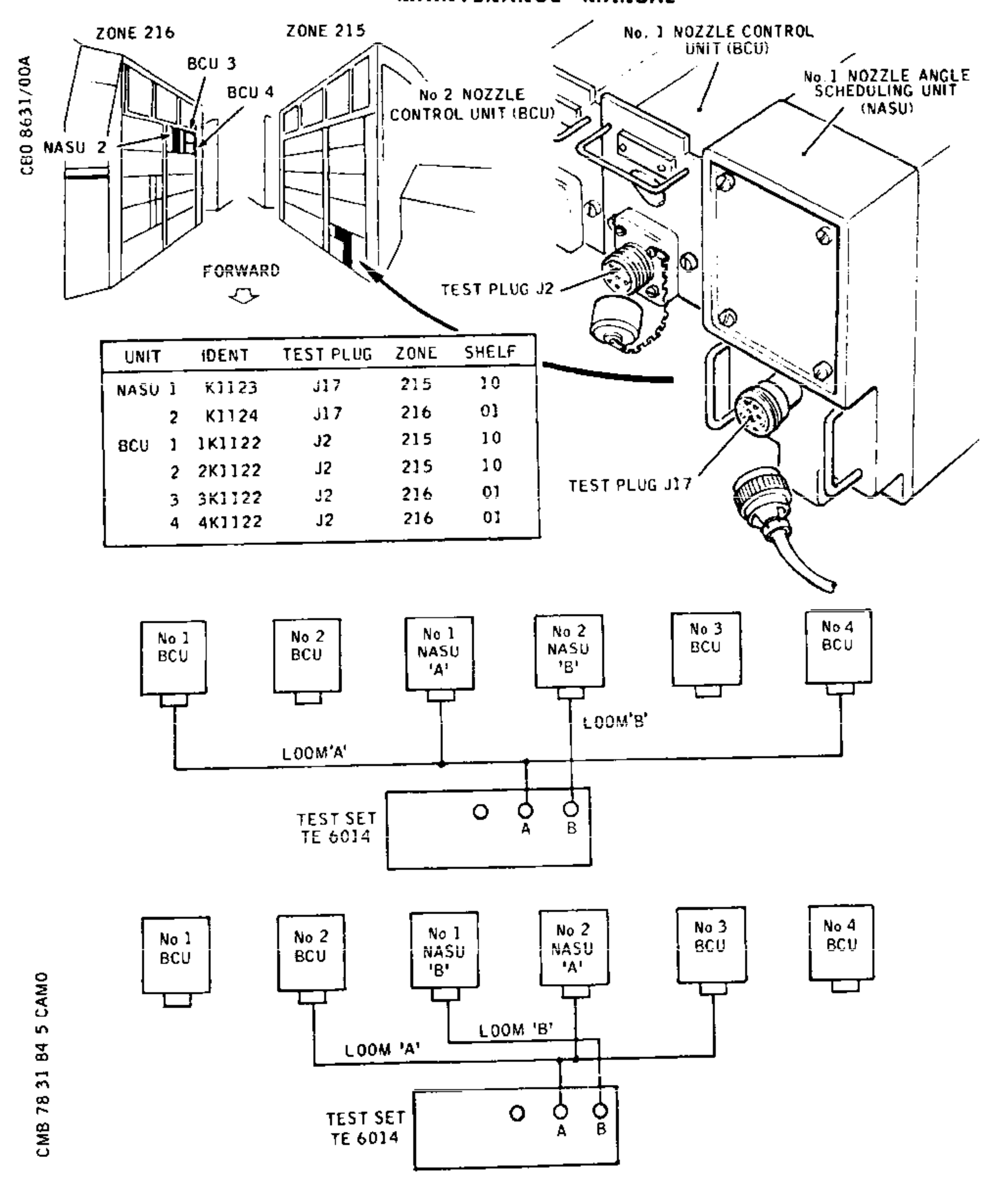
Light Emitting Diode (LED) Display
Table 501

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R

NASU Test Set
Figure 502



UNIT	IDENT	TEST PLUG	ZONE	SHELF
NASU 1	K1123	J17	215	10
2	K1124	J17	216	01
BCU 1	1K1122	J2	215	10
2	2K1122	J2	215	10
3	3K1122	J2	216	01
4	4K1122	J2	216	01

NASU, BCU Location and Test Set Connections - Schematic
Figure 503

R A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Test Set	TE 6014
Digital Voltmeter 0-10 range	-

R B. Prepare

(1) Trip the following circuit breakers and fit safety clips:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
NASU 1 SUP	14-216	K1136	A 7
NASU 2 SUP	13-215	K1137	B13
NASU 1 PROG CONT	15-216	K1134	C 9
NASU 2 PROG CONT	15-215	K1135	F17
NASU TEST SUP	15-215	K1133	E17
'E' SCHD SUP 1	1-213	K34	E 7
'E' SCHD SUP 2	3-213	K35	B 3
ENG 1 REV THRUST ASOV CONT	3-213	1K334	G 3
ENG 2 REV THRUST ASOV CONT	1-213	2K334	D 7
ENG 3 REV THRUST ASOV CONT	1-213	3K334	D 8
ENG 4 REV THRUST ASOV CONT	3-213	4K334	G 4
ENG 1 BUCKET CONT UNIT SUP	14-215	1K1132	E12
ENG 2 BUCKET CONT UNIT SUP	13-215	2K1132	G14
ENG 3 BUCKET CONT UNIT SUP	13-216	3K1132	C 6
ENG 4 BUCKET CONT UNIT SUP	14-216	4K1132	C 6

(2) Check that the following aircraft conditions are satisfied (Ref. Fig. 501):

(a) All throttle levers set at 'idle'.

(b) All REHEAT switches selected "OFF".

(c) All engine shut down handles in the normal forward position.

(d) ADC 1 and ADC 2 switches selected "OFF".

(e) NASU programme selector switch selected "NORMAL".

(f) 'E' Schedule switch selected "AUTO".

(g) NASU TEST switch selected "OFF".

(h) Main landing gear weight switches in the 'on ground' configuration.

(j) Nozzle angle less than 27°.

(3) Check that the test set switches are set as follows (Ref. Fig. 502):

(a) Power control switch selected "OFF".

(b) ADC/SIM switch selected "ADC".

(c) Mode selector switch as required.

(4) Connect the test set looms between the test set and the aircraft equipment front connectors (Ref. Fig. 503).

(5) Reset the circuit breakers previously tripped and check that the following circuit breakers are also set:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ADC 1 26V SUP	2-213	1F78	A 2
ADC 2 26V SUP	13-216	2F78	F14
ENG 1 RATING CONT	3-213	1K8	C 8
ENG 2 RATING CONT	1-213	2K8	E 8
ENG 3 RATING CONT	1-213	3K8	E 2
ENG 4 RATING CONT	3-213	4K8	C 4
ENG 1 REHEAT CONT	15-216	1K1542	E 9
ENG 2 REHEAT CONT	15-215	2K1542	D15
ENG 3 REHEAT CONT	15-215	3K1542	D16
ENG 4 REHEAT CONT	15-216	4K1542	E10
LH U/C WEIGHT SW B SYS SUP	3-213	G293	B 8
RH U/C WEIGHT SW A SYS SUP	1-213	G295	M18

(6) Complete the following procedure:

(a) Check that the NOZZLE caption is illuminated.

(b) Check that the ADC 1 and ADC 2 TEST switches are at "NORM".

(c) Select ADC 1 and ADC 2 switches "ON".

(d) Check that the NOZZLE caption is extinguished.

(7) Select the test set power control switch "ON" and check that the green GO caption illuminates and the digital TEST NO. read out shows "00", indicating that start conditions are satisfied. Check also that the LED A6 is on and indications are correct for GO lamp illumination as follows:

LED		INDICATION
B1	ON -	NASU 'A' FLT plug link serviceable
B2	OFF -	power reduced setting satisfied
B3	OFF -	weight switches 'on ground'
B4	ON -	NASU 'B' FLT plug link serviceable
B5	ON -	ADC's 1 & 2 ON (no mach fail cond)
C3	ON -	'E' Sched AUTO supply present
C4	OFF -	"FLYOVER" not selected.
D2	OFF -	"APPROACH" not selected
D4	ON -	NASU TEST switch "OFF" and NOZZLE caption extinguished.

NOTE: If, with the power control switch at "ON", the GO caption is extinguished and the red FAIL TEST lamp is illuminated, check the LED display to determine which parameter is incorrect.

If one or more parameters are incorrect, after rectification the FAIL TEST caption will automatically extinguish and the GO caption will illuminate.

If circumstances prevent certain parameter requirements from satisfying the 'GO lamp on' state, the the NASU tests may still be carried out providing the effect of the missing parameters is considered at any subsequent FAIL TEST.

C. Self Test

R (1) Select the mode switch to "SELF TEST".

R (2) Select the ADC/SIM switch to "ADC".

R (3) Select the power control switch to "ON".

R (4) Momentarily depress the GO caption and confirm that
R the SELF TEST programme is selected and indicated
R by the following:

R (a) the GO lamp is extinguished.

R (b) the FAIL TEST lamp is illuminated.

R (c) the TEST NO. display reads "70".

R NOTE: When the LAMP TEST caption is pressed,
R all lamps and LED's are illuminated
R and the TEST NO. display reads "88".
R In the SELF TEST mode, this test is used
R to initiate the SELF TEST sequence.

R (5) Momentarily depress the LAMP TEST caption and check
R the following:

R (a) the FAIL TEST lamp is extinguished.

R (b) the TEST NO. display progresses from "70" to
R "79" omitting 71, and from "79" to "00".

R (c) the GO lamp illuminates, indicating that its
R start conditions are still satisfied.

R D. Run Test (Ref. Table 502)

R (1) Select the power control switch to "ON".

R (2) Select the mode switch to "RUN".

R (3) Select the ADC/SIM switch to "ADC".

R (4) Check that the TEST NO. display reads "00"
R and the GO lamp is illuminated, indicating that
R start conditions are satisfied.

R (5) Momentarily depress the GO caption, which will
R extinguish, and check the following:

R (a) the TEST No. display progresses from "00"
R to "31" omitting test positions 02 and 03.

(b) at test "31" the sequence stops and the FAIL TEST caption illuminates.

(6) Select the flight compartment NASU TEST switch to the NASU 'B' position (Ref. Fig. 503) and check that the FAIL TEST caption is extinguished.

(7) Momentarily depress the GO caption and check that the programme continues to "33" followed by "00" and the FAIL TEST caption illuminated.

(8) Select the flight compartment NASU TEST switch "OFF" and check that the FAIL TEST lamp is extinguished and the GO lamp is illuminated, indicating that start conditions are satisfied.

NOTE: If the test sequence halts with the FAIL TEST caption illuminated, the TEST No. display indicates the failed test position and the LED display can be used to determine which parameter caused the failure. If the parameter fault is then rectified the FAIL TEST lamp will go off. To continue the test sequence, momentarily depress the GO caption.

If the test sequence is stopped by a fault which is not rectified, testing may be continued by pressing the GO caption.

E. Single Test

(1) Select the power control switch "ON".

(2) Select the mode switch to "SINGLE TEST".

(3) Select the ADC/SIM switch to "ADC".

(4) Check that the TEST NO. display reads "00" and that the GO lamp is illuminated, indicating that start conditions are satisfied.

(5) Momentarily depress the GO caption which will extinguish, and check that the test number steps to "01".

NOTE: Test positions 02 and 03 are by-passed and the next step in sequence is 04.

The procedure to continue Single Testing is the same whether the previous test was satisfactory or not. Momentarily depress the GO caption.

The GO caption (if on) will be extinguished. The digital read out will continue to display the previous Test No. This condition indicates that the test set has been manually stepped out of the test programme and is ready to GO into the next test.

The GO lamp function on these 'half steps' is independent of the aircraft state requirements for its function when the test set is switched on and/or is at the "00" display position.

(6) If the FAIL TEST caption is extinguished, proceed with the next test in sequence by momentarily depressing the GO caption twice.

(7) If the FAIL TEST caption is illuminated:

(a) Diagnose and rectify the fault when the FAIL TEST indication will cancel and the procedure may continue as in operation (6).

(b) Continue the test procedure without rectifying the fault by momentarily pressing the GO caption twice.

(8) Continue the single test sequence until, at test 31, the FAIL TEST lamp illuminates.

(9) Select the flight compartment NASU TEST switch to the NASU 'B' position (Ref. Fig. 503) and check that the FAIL TEST lamp is extinguished.

(10) Continue the single test sequence until the TEST No. display progresses from "33" to "00", at which step the FAIL TEST caption illuminates.

(11) Select the flight compartment NASU TEST switch to "OFF" and check that the FAIL TEST caption is extinguished and the GO lamp is illuminated, indicating that the start conditions are satisfied.

F. Sim Test

(1) Check that the ADC SIM potentiometer is turned fully counter clockwise.

(2) Select the power control switch "ON".

(3) Select the ADC/SIM switch to "SIM" and press the GO caption and check that the TEST NO. display

changes instantly from "00" to "50".

NOTE: At this point the test set is supplying a zero mach signal to NASU 'A'.

(4) Turn the ADC SIM potentiometer clockwise to vary the mach signal from 0 to - 10 V d.c.

NOTE: The NASU responses to this mach change will be as for the aircraft systems normal function when the mach signal is derived from the ADC.

(5) When SIM testing is completed, turn the potentiometer fully counter clockwise and select the ADC/SIM switch to ADC.

R (6) If required, momentarily depress the GO caption to return the TEST NO. display to "00" and illuminate the GO lamp indicating start conditions satisfied.

G. Conclusion

(1) Select the test set power control switch "OFF" and trip NASU 1 & 2 SUP circuit breakers (Ref. para 4. B(1)).

(2) Disconnect the test set looms A and B.

(3) Replace the caps on the BCU front connectors and refit NASU 1 & 2 flight plugs.

(4) Reset the circuit breakers tripped in operation (1) and check that the NOZZLE caption is extinguished.

(5) Replace and secure the flight compartment racking covers.

	COLUMN A			COLUMN B		
	OUTPUT SIGNALS FROM THE TEST SET TO THE NASU			OUTPUT SIGNALS FROM THE NASU TO THE TEST SET		
TEST NO		SIGNAL	LED		SIGNAL	LED
01	- - -			ADC mach pot excit	-10 Vac	A1

	COLUMN A			COLUMN B		
	OUTPUT SIGNALS FROM THE TEST SET TO THE NASU			OUTPUT SIGNALS FROM THE NASU TO THE TEST SET		
				ation voltage	± 0.1	
02	No test allocated					
03	No test allocated					
04	Mach No approx 0.35	0.5 Vdc ± 0.02	--	NASU 'A' BCU signal	5.50 Vdc + 0.2	A2
05	Mach No approx 0.35	0.5 Vdc ± 0.02	--	NASU output monitored at BCU 'A' connector	5.06 Vdc + 0.2 - 0.3	--
06	Mach No approx 0.8	2.5 Vdc ± 0.02	--	NASU 'A' BCU signal	3.80 Vdc + 0.2 - 0.3	A2
07	Mach No approx 0.8	2.5 Vdc ± 0.02	--	NASU output monitored at BCU 'B' connector	3.45 Vdc + 0.2 - 0.3	--
08	Mach No approx 1.0	3.5 Vdc ± 0.02	--	NASU 'A' BCU signal (LED A2 may not illuminate at this signal level)	2.00 Vdc + 0.2 - 0.3	A2
09	Mach No approx 1.0	3.5 Vdc ± 0.02	--	NASU output monitored at BCU 'A' connector	1.85 Vdc + 0.2 - 0.3	--
10	T alpha dc signal, -61°C	3.52Vdc ± 0.01	--	T alpha frequency	2.30 kHz ± 10%	--
R R R 11	T alpha dc signal, at T equal or greater than -46.5°C	3.64Vdc ± 0.01	--	T alpha signal to engine control unit	0.00 Vac + 0.25 - 0.00	--
12	T alpha dc signal, -61°C	3.52Vdc ±0.01	--	T alpha signal to engine control	2.28 Vac ± 0.25	--

	COLUMN A			COLUMN B		
	OUTPUT SIGNALS FROM THE TEST SET TO THE NASU			OUTPUT SIGNALS FROM THE NASU TO THE TEST SET		
				unit		
13	T alpha dc signal, at -78.3°C	3.37Vdc ± 0.01	--	T alpha signal to engine control unit	5.00 Vac ± 0.25	--
14	T alpha dc signal, at T equal or less than -78.3°C	3.18Vdc ± 0.01	--	T alpha signal to engine control unit	5.00 Vac + 2.50 - 0.25	--
	NOTE: These T alpha signals are derived from the d.c. reference supply from the aircraft ADC to the NASU.					
	ADC reference signal	20.0 Vdc ± 2.00	D1			
15	(NORMAL MODE - GREATER THAN VCO - LIFT OFF (L/O) ON - 'E' HIGH SCHEDULE)					
	Flyover	0.0 V	C4	'E' High Schedule	28.0 Vdc	E1
	Approach	0.0 V	D2	'E' Flyover Sched	0.0 V	D5
	Greater than VCO	0.0 V	C5	'E' Approach (Mid)	0.0 V	E2
	L/O ON	28.0 Vdc	B3	NASU not failed	28.0 Vdc	D4
	Power reduce	0.0 V	B2			
	No test fail	0.0 V	C2			
16	(NORMAL MODE - GREATER THAN VCO - L/O OFF - MAX POWER - 'E' HIGH SCHEDULE)					
	Flyover	0.0 V	C4	'E' High Schedule	28.0 Vdc	E1
	Approach	0.0 V	D2	'E' Flyover Sched	0.0 V	D5
	Greater than VCO	0.0 V	C5	'E' Approach (Mid)	0.0 V	E2
	L/O OFF	0.0 V	B3	NASU not failed	28.0 Vdc	D4
	Max power	28.0 Vdc	B2			
	No test fail	0.0 V	C2			

	COLUMN A			COLUMN B		
	OUTPUT SIGNALS FROM THE TEST SET TO THE NASU			OUTPUT SIGNALS FROM THE NASU TO THE TEST SET		
17	(NORMAL MODE - LESS THAN VCO - L/O OFF - POWER REDUCED - 'E' LOW SCHEDULE)					
	Flyover	0.0 V	C4	'E' High Schedule	0.0 V	E1
	Approach	0.0 V	D2	'E' Flyover Sched	0.0 V	D5
	Less than VCO	28.0 Vdc	C5	'E' Approach (Mid)	0.0 V	E2
	L/O OFF	0.0 V	B3	NASU not failed	28.0 V	D4
	Power reduce	0.0 V	B2			
	No test fail	0.0 V	C2			
18	(NORMAL MODE - LESS THAN VCO - POWER REDUCED - 'E' LOW SCHED)					
	Flyover	0.0 V	C4	'E' High SChedule	0.0 V	E1
	Approach	0.0 V	D2	'E' Flyover Sched	0.0 V	D5
	Less than VCO	28.0 Vdc	C5	'E' Approach (Mid)	0.0 V	E2
	L/O ON	28.0 Vdc	B3	NASU not failed	28.0 Vdc	D4
	Power reduce	0.0 V	B2			
	No test fail	0.0 V	C2			
19	(APPROACH MODE - GREATER THAN VCO - L/O ON -POWER REDUCED - 'E' APPROACH MID SCHEDULE)					
	Flyover	0.0 V	C4	'E' High Schedule	0.0 V	E1
	Approach	28.0 Vdc	D2	'E' Flyover Sched	0.0 V	D5
	Greater than VCO	0.0 V	C5	'E' Approach (Mid)	28.0 Vdc	E2
	L/O ON	28.0 Vdc	B3	NASU not failed	28.0 Vdc	D4
	Power reduce	0.0 V	B2			
	No test fail	0.0 V	C2			
20	(APPROACH MODE - LESS THAN VCO - MAX POWER - 'E' APPROACH MID SCHEDULE)					
	Flyover	0.0 V	C4	'E' High Schedule	0.0 V	E1
	Approach	28.0 Vdc	D2	'E' Flyover Sched	0.0 V	D5
	Less than VCO	28.0 Vdc	C5	'E' Approach (Mid)	28.0 Vdc	E2
	L/O ON	28.0 Vdc	B3	NASU not failed	28.0 Vdc	D4
	Max power	28.0 Vdc	B2			
	No test fail	0.0 V	C2			
21	(APPROACH MODE - LESS THAN VCO - L/O ON, OFF, ON (0.25 SEC) - POWER REDUCED - 'E' APPROACH MID SCHEDULE)					

COLUMN A			COLUMN B		
OUTPUT SIGNALS FROM THE TEST SET TO THE NASU			OUTPUT SIGNALS FROM THE NASU TO THE TEST SET		
Flyover	0.0 V	C4	'E' High Schedule	0.0 V	E1
Approach	28.0 V	D2	'E'Flyover Sched	0.0 V	D5
Less than VCO	28.0 Vdc	C5	'E' Approach (Mid)	28.0 Vdc	E2
L/O ON,OFF,ON (0.25 sec)	28.0-28 Vdc	B3	NASU not failed	28.0 Vdc	D4
Power reduce	0.0 V	B2			
No test fail	0.0 V	C2			

22 (APPROACH MODE - LESS THAN VCO - L/O OFF - POWER REDUCED - 'E' LOW SCHEDULE)

Flyover	0.0 V	C4	'E' High Schedule	0.0 V	E1
Approach	28.0 Vdc	D2	'E' Flyover Sched	0.0 V	D5
Less than VCO	28.0 Vdc	C5	'E' Approach (Mid)	0.0 V	E2
L/O OFF	0.0 V	B3	NASU not failed	28.0 Vdc	D4
Power reduce	0.0 V	B2			
No test fail	0.0 V	C2			

23 (FLYOVER MODE - LESS THAN VCO - L/O OFF - POWER REDUCED - 'E' LOW SCHEDULE)

Flyover	28.0 Vdc	C4	'E' High Schedule	0.0 V	E1
Approach	0.0 V	D2	'E' Flyover Sched	0.0 V	D5
Less than VCO	28.0 Vdc	C5	'E' Approach (Mid)	0.0 V	E2
L/O OFF	0.0 V	B3	NASU not failed	28.0 Vdc	D4
Power reduce	0.0 V	B2			
No test fail	0.0 V	C2			

24 (FLYOVER MODE - LESS THAN VCO - L/O ON - POWER REDUCED - 'E' LOW SCHEDULE)

Flyover	28.0 V	C4	'E' High Schedule	0.0 V	E1
Approach	0.0 V	D2	'E' Flyover Sched	0.0 V	D5
Less than VCO	28.0 Vdc	C5	'E' Approach (Mid)	0.0 V	E2
L/O ON	28.0 Vdc	B3	NASU not failed	28.0 Vdc	D4
Power reduce	0.0 V	B2			
No test fail	0.0 V	C2			

25 (FLYOVER MODE - LESS THAN VCO - L/O ON - MAX POWER - 'E' LOW SCHEDULE)

Flyover	28.0 Vdc	C4	'E' High Schedule	0.0 V	E1
Approach	0.0 V	D2	'E' Flyover Sched	0.0 V	D5

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COLUMN A			COLUMN B		
OUTPUT SIGNALS FROM THE TEST SET TO THE NASU			OUTPUT SIGNALS FROM THE NASU TO THE TEST SET		
Less than VCO	28.0 Vdc	C5	'E' Approach (Mid)	0.0 V	E2
L/O ON	28.0 Vdc	B3	NASU not failed	28.0 Vdc	D4
Max power	28.0 Vdc	B2			
No test fail	0.0 V	C2			

26 (FLYOVER MODE - GREATER THAN VCO - L/O ON - MAX POWER - MACH GREATER THAN 1.0 - 'E' HIGH AND NOZZLE CAPTION WARNING)

Flyover	28.0 Vdc	C4	'E' High Schedule	28.0 Vdc	E1
Approach	0.0 V	D2	'E' Flyover Sched	0.0 V	D5
Greater than VCO	0.0 V	C5	'E' Approach (Mid)	0.0 V	E2
L/O ON	28.0 Vdc	B3	NASU fail (caption)	0.0 V	D4
Max power	28.0 Vdc	B2			
No test fail	0.0 V	C2			
Mach greater than 1.0	4.0 Vdc	--			

27 (FLYOVER MODE - GREATER THAN VCO - L/O ON - POWER REDUCED - MACH GREATER THAN 1.0 - 'E' HIGH AND NOZZLE CAPTION WARNING)

Flyover	28.0 Vdc	C4	'E' High Schedule	28.0 Vdc	E1
Approach	0.0 V	D2	'E' Flyover Sched	0.0 V	D5
Greater than VCO	0.0 V	C5	'E' Approach (Mid)	0.0 V	E2
L/O ON	28.0 Vdc	B3	NASU fail (caption)	0.0 V	D4
Power reduce	0.0 V	B2			
No test fail	0.0 V	C2			
Mach greater than 1.0	4.0 Vdc	--			

28 (FLYOVER MODE - GREATER THAN VCO - L/O ON - POWER REDUCED - MACH LESS THAN 1.0 - 'E' FLYOVER SCHEDULE)

Flyover	28.0 Vdc	C4	'E' High Schedule	0.0 V	E1
Approach	0.0 V	D2	'E' Flyover Sched	28.0 Vdc	D5
Greater than VCO	0.0 V	C5	'E' Approach (Mid)	0.0 V	E2
L/O ON	28.0 Vdc	B3	NASU not failed	28.0 Vdc	D4
Power reduced	0.0 V	B2	NASU 'A' ASOV	0.0 V	D3
No test fail	0.0 V	C2	NASU 'A' ASOV	0.0 V	E3
Mach less than 1.0	2.0 Vdc ± 0.02	--			

COLUMN A			COLUMN B		
OUTPUT SIGNALS FROM THE TEST SET TO THE NASU			OUTPUT SIGNALS FROM THE NASU TO THE TEST SET		

29 (FLYOVER MODE - GREATER THAN VCO - L/O ON - MAX POWER - MACH LESS THAN 1.0 - 'E' HIGH SCHEDULE)

Flyover	28.0 Vdc	C4	'E' High Schedule	28.0 Vdc	E1
Approach	0.0 V	D2	'E' Flyover Sched	0.0 V	D5
Greater than VCO	0.0 V	C5	'E' Approach (Mid)	0.0 V	E2
L/O ON	28.0 Vdc	B3	NASU not failed	28.0 Vdc	D4
Max power	28.0 Vdc	B2	NASU 'A' ASOV	0.0 V	D3
No test fail	0.0 V	C2	NASU 'A' ASOV	0.0 V	E3
Mach less than 1.0	2.0 Vdc ± 0.02	--			

30 (NORMAL MODE - GREATER THAN VCO - MACH GREATER THAN 1.2 - ASOV FUNCTION = 'E' HIGH SCHEDULE)

Flyover	0.0 V	C4	'E' High Schedule	28.0 Vdc	E1
Approach	0.0 V	D2	'E' Flyover Sched	0.0 V	D5
Greater than VCO	0.0 V	C5	'E' Approach (Mid)	0.0 V	E2
No test fail	0.0 V	C2	NASU not failed	28.0 Vdc	D4
Mach greater than 1.2	4.5 Vdc ± 0.02		NASU 'A' ASOV	28.0 Vdc	D3
			NASU 'A' ASOV	28.0 Vdc	E3

31 (NORMAL MODE - GREATER THAN VCO - MACH GREATER THAN 1.2 - NASU 'B' MANUAL FAIL - ASOV CHANGEOVER)

Flyover	0.0 V	C4	'E' High Schedule	28.0 Vdc	E1
Approach	0.0 V	D2	'E' Flyover Sched	0.0 V	D5
Greater than VCO	0.0 V	C5	'E' Approach (Mid)	0.0 V	E2
No test fail	0.0 V	C2	NASU 'B' failed	0.0 V	D4
Mach greater than 1.2	4.5 Vdc ± 0.02	--	NASU 'A' to 'B' ASOV signal	28.0 V	D6
			NASU 'A' to 'B' ASOV signal	28.0 V	E6

NOTE: Select flight deck NASU TEST switch to fail NASU 'B' for tests 31 to 33

COLUMN A			COLUMN B		
OUTPUT SIGNALS FROM THE TEST SET TO THE NASU			OUTPUT SIGNALS FROM THE NASU TO THE TEST SET		

32 (NORMAL MODE - GREATER THAN VCO - MACH APPROX 1.0 - NASU 'B' MANUAL FAIL - BCU CHANGEOVER)

Flyover	0.0 V	C4	'E' High SChedule	28.0 V	E1
Approach	0.0 V	D2	'E' Flyover Sched	0.0 V	D5
Greater than VCO	0.0 V	C5	'E' Approach (Mid)	0.0 V	E2
No test fail	0.0 V	C2	NASU 'B' failed	0.0 V	D4
Mach approx 1.0	3.5 Vdc ±0.02		NASU 'A' to 'B' BCU CHANGEOVER signal	2.0 Vdc ± 0.20 - 0.50	A3

NOTE: LED A3 may not illuminate at this signal level.

33 (NORMAL MODE - GREATER THAN VCO - MACH APPROX 1.0 - NASU 'A' AUTO FAIL - NASU 'B' MANUAL FAIL)

Flyover	0.0 V	C4	'E' High Schedule	0.0 V	E1
Approach	0.0 V	D2	'E' Flyover Sched	0.0 V	D5
Greater than VCO	0.0 V	C5	'E' Approach (Mid)	0.0 V	E2
Test fail	28.0 Vdc	C2	NASU 'A'/'B' failed	0.0 V	D4
Mach approx 1.0	3.5 Vdc ± 0.02		NASU 'A' BCU signal	0.0 Vdc ± 0.20	

00 A satisfactory test sequence halts at TEST No "00" with the FAIL TEST caption illuminated. Select the flight deck NASU TEST switch "OFF" to extinguish the FAIL TEST caption and illuminate the GO caption.

NOTE: The signal and LED functions tabled above are those directly relevant to the test procedure, other LED's

COLUMN A	COLUMN B
OUTPUT SIGNALS FROM THE TEST SET TO THE NASU	OUTPUT SIGNALS FROM THE NASU TO THE TEST SET

will change state throughout the tests.

A FAIL TEST condition will occurr when the column 'B' requirements of the test sequence table are either absent or outside the given tolerance.

Programmed Test Sequence
Table 502

BUCKET CONTROL UNIT (NOZZLE AND THRUST REVERSE CONTROLLER) - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The four bucket control units (BCU's), one for each engine, consist of a double elfin case mounted on shelves 10-215 for engines 1 and 2 and 1-216 for engines 3 and 4, in the flight compartment equipment racking.

2. Bucket Control Unit

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

B. Prepare to Remove BCU

(1) Electrically isolate the BCU by tripping the appropriate circuit breakers. Fit circuit breaker safety clips.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
R	ENG 1 BUCKET CONT UNIT SUP	14-215	1K1132	E12
R	ENG 1 REV THRUST ASOV CONT	3-213	1K334	G 3
R	ENG 2 BUCKET CONT UNIT SUP	13-215	2K1132	G14
R	ENG 2 REV THRUST ASOV CONT	1-213	2K334	D 7
R	ENG 3 BUCKET CONT UNIT SUP	13-216	3K1132	C 6
R	ENG 3 REV THRUST ASOV CONT	1-213	3K334	D 8
R	ENG 4 BUCKET CONT UNIT SUP	14-216	4K1132	C 6
R	ENG 4 REV THRUST ASOV CONT	3-213	4K334	G 4

(2) Remove the cover from the appropriate racking and

identify the BCU to be removed.

ENGINE	ELECTRICAL IDENT	SHELF
1	1K1122	10-215
2	2K1122	10-215
3	3K1122	1-216
4	4K1122	1-216

C. Remove BCU

R B NOTE: When removing/installing the "Bucket Control Unit"
R B make an entry in the Aircraft Technical Report
R B (Sector Defect Log) that a secondary nozzle ASOV
R B check must be carried out on departure from that
R B station/base.

(1) Loosen the two captive securing nuts.

(2) Grasp the carrying handle and carefully withdraw the BCU from the backplate connector; remove the BCU from the shelf.

D. Install BCU

(1) Comply with the electrical safety precautions.

(2) Check that the mating surfaces of the backplate and racking are clean and undamaged.

(3) Slide the amplifier into the shelf and carefully engage the backplate connector.

(4) Engage the hold down assembly and tighten the securing nuts, ensuring that the BCU is bonded in accordance with 20-27-11.

E. Conclusion

(1) Refit and secure the racking cover.

(2) Remove the safety clips and reset the circuit breakers tripped before removal.

(3) Perform a Functional Test of the system (Ref. 78-31-85, Adjustment/Test)

(4) Perform Bucket Control System Wind-Down Test (Ref.78-00-00, Adjustment/Test).

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BUCKET CONTROL UNIT (NOZZLE AND THRUST REVERSE CONTROLLER) - ADJUSTMENT/TEST

1. General

For test requirements on this unit, refer to 78-36-01, Adjustment/Test.

BUCKET BALLSCREW GEARBOX - SERVICING

1. General

Bucket ballscrew gearboxes must be periodically relubricated. The instructions given in this chapter describe the procedure to follow when relubricating ballscrew gearboxes. All BA ballscrews feature SBOL.593-78-24.

R B CAUTION: IT IS IMPORTANT TO ENSURE THAT THE BALLSCREW GEARBOX
R B IS CORRECTLY LUBRICATED. FAILURE TO DO SO MAY RESULT
R B IN GEARBOX SEIZURE AND SUBSEQUENT LOSS OF CONTROL OF
R B SECONDARY NOZZLE.

2. Relubrication of the Bucket Ballscrew Gearbox (Ref. Fig.301 and 302)

A. Equipment and Materials

DESCRIPTION	PART NO.
Special wrench for rod end bearing	9970-511-043
Extension	9970-515-296
Torque wrench (0 to 3 daN.m range, 0 to 265 lbf.in.)	-
Pneumatic vibration screwdriver pre-adjusted at 0,60 daN.m.(53 lbf.in.) and the appropriate screwdriver head.	-
Pneumatic impact wrench (unscrewing mode) ARO 8530 PC 1 and the appropriate screwdriver head.	-
Circuit breaker safety clips	-
Anti-seizure compounds	Lubricant S,P and R (Ref. 70-00-01)
Never Seez Grease NSN 165B	
Grease Gun Code HJCG 0003	
Never Seez Aerosol Spray Code NFLA 6106	

B. Prepare to Relubricate the Bucket Ballscrew Gearbox

(1) Electrically isolate the engine and exhaust assembly services indicated in Table 301 by tripping the circuit breakers affecting engines in the nacelle upon which work is being carried out. Fit circuit breaker safety clips.

<u>WARNING:</u> MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE ON WHICH THE REMOVAL IS CARRIED OUT.

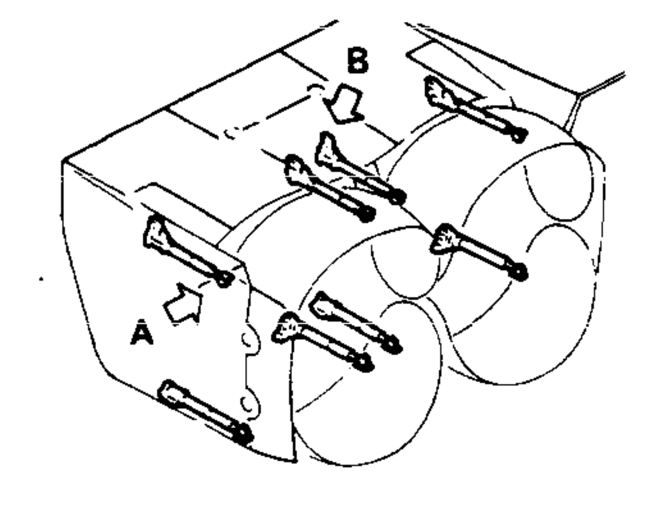
SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINE No.1			
BUCKET CONT UNIT SUP	14-215	1K1132	E12
REV THRUST CONT	3-213	1K331	D 1
ENGINE No.2			
BUCKET CONT UNIT SUP	13-215	2K1132	G14
REV THRUST CONT	1-213	2K331	B 5
ENGINE No.3			
BUCKET CONT UNIT SUP	13-216	3K1132	C 6
REV THRUST CONT	1-213	3K331	B 6
ENGINE No. 4			
BUCKET CONT UNIT SUP	14-216	4K1132	C 6
REV THRUST CONT	3-213	4K331	D 2

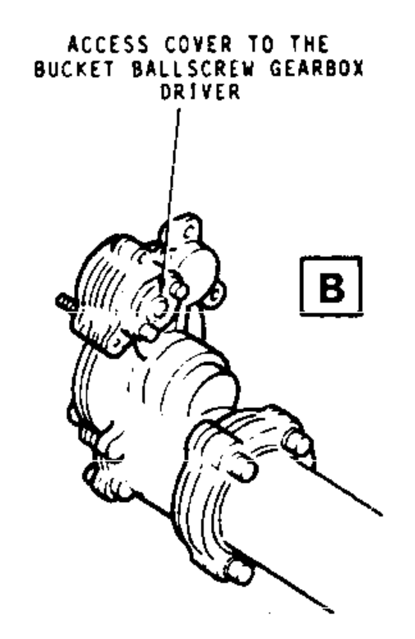
Circuit Breakers
Table 301

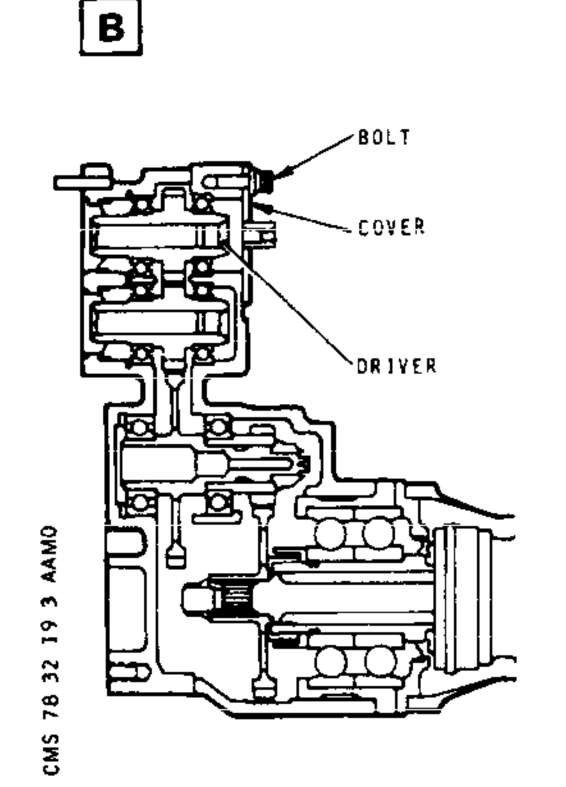
(2) Display a suitable placard on the engine starting panel, indicating that personnel are working on the engines and the twin secondary nozzle area.

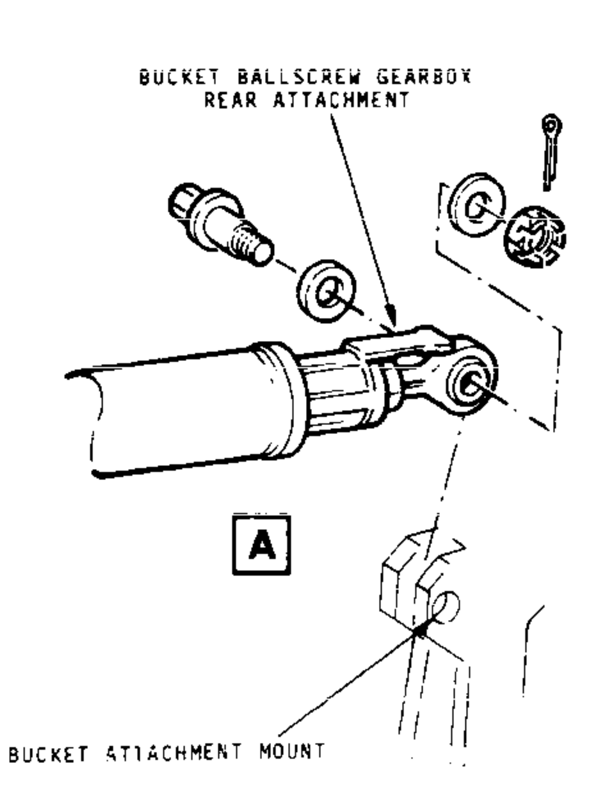
(3) Remove the access panels to the bucket ballscrew gear-boxes to be relubricated, using a pneumatic impact wrench equipped with an appropriate screwdriver head.

<u>CAUTION:</u> USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.
USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.
BEFORE CARRYING OUT ANY WORK, THE SECOND-ARY NOZZLE MUST BE LINED WITH RUBBER









Bucket Ballscrew Gearbox - Servicing
Figure 301

BUCKET

X

ROD END BEARING

BALLSCREW GEARBOX

Y

STOP ASSEMBLY

LUBRICATION HOLE

F

STOP ASSEMBLY

STRAP COVER

F

WASHER

ROD END BEARING

LOCK NUT

LOCK PIN

CMS 78 32 19 3 BAMO

Bucket Ballscrew Gearbox - Servicing
Figure 302

CARPETS TO AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES MUST ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

(4) On one of the bucket ballscrew gearboxes remove the access cover to the ballscrew gearbox driver (Ref. Fig. 301)(Detail B).

(5) Using the appropriate extension, move the buckets to a position of 45 degrees approx., by turning the ballscrew driver (Ref. Fig. 301)(Detail B).

C. Relubrication of the Bucket Ballscrew Gearbox Screwshaft

(1) Disconnect the bucket ballscrew gearbox from the bucket by removing the bucket/ballscrew gearbox attaching bolt.

NOTE: Disconnect and relubricate one bucket ballscrew gearbox at a time to prevent re-rigging of the system.

(2) Holding the bucket ballscrew gearbox, manually rotate the screwshaft housing assembly until gearbox stroke X = 112 mm (4.50 in.) (Ref. Fig. 302).

(3) Remove the lockwire securing the strap cover blanking the lubrication hole. Remove the strap cover (Ref. Fig. 302).

(4) Check the position of the grease fittings in relation with the lubrication hole. If necessary manually rotate the housing assembly until one of the grease fitting is aligned and accessible through the lubrication hole.

(5) Remove any dirt or deposits from the grease fitting using a piece of lint-free cloth wetted with a suitable solvent such as white spirit.

NOTE: Check that the grease fitting obstructing ball is free.

(6) Using grease gun Code HJCG 003 filled with Grease Never Seez Nickle NSN 165B apply 5cc of grease through nipple (approx 8 strokes).

(7) Remove the excess of lubricant using a clean piece of lint-free cloth.

(8) Wind the ballscrew to full extension using the Never Seez aerosol can Code NFLA 6106 with an extension tube apply the lubricant through the nipple access hole in the jack shroud to coat the screw. Apply in both directions, i.e. towards the gearbox and towards the jack attachment to bucket, then wind the pack to the fully retract position and back again to fully extended.

(9) Repeat the procedures as in Item (8).

(10) Reinstall the strap cover blanking the lubrication access hole and secure with lockwire.

D. Relubrication of the Bucket Ballscrew Gearbox Rod End Bearing

(1) Using a suitable solvent such as white spirit, clean the rod end bearing assembly. Remove any residual coked exhaust gas residues from the bearing with a rubbing compound.

(2) Examine the rod end bearing looking for excessive wear or excessive play of the bearing inside the rod end and if necessary, proceed to its replacement as follows:

(a) On slotted entry rod end bearing assembly, remove the damaged bearing and install a new bearing.

(b) On non-slotted entry rod end bearing assembly, proceed to the replacement of the rod end bearing assembly (Ref. Fig. 302)(Detail F) as follows:

(b1) Cut the lock-wire from the lock-nut and lock-pin.

(b2) Measure and record the rod end bearing assembly adjustment length from the face of the stop assembly (Dimension Y).

(b3) Unscrew the lock-nut until the lock-pin is free, using the special wrench to hold the rod-end bearing assembly.

(b4) Remove and discard the rod end bearing assembly.

(b5) Install the lock-pin, the lock-nut and the washer on to the new rod end bearing assembly.

(b6) Install the rod end bearing assembly on the ballscrew gearbox and position it to respect the adjustment length from the face of the stop assembly as noted with the removed rod end bearing assembly (Dimension Y).

(b7) Tighten the lock-nut to 2,8 daN.m (250 lbf.in.).

(b8) Wire-lock the lock-nut and lock-pin.

(3) Lubricate the rod end bearing assembly with lubricants (Ref. 70-00-01, Servicing and Storage Materials).

E. Reconnection of the Bucket Ballscrew Gearbox to the Bucket

(1) Apply lubricant S (Ref. 70-00-01, Servicing and Storage Materials to the bucket/ballscrew gearbox attaching bolt, nut, washers and pin.

(2) Manually rotate the screwshaft housing assembly to approach and to engage the rod end bearing in the bucket attachment.

(3) Install the bucket/ballscrew gearbox attaching bolt complete with the two washers (Ref. Fig. 301) (Detail A).

(4) Install the castellated nut and torque-tighten between 1,10 and 1,25 daN.m (95 to 110 lbf.in.).

(5) Lock the nut with a split pin.

F. Conclusion

(1) Using the appropriate extension, bring back the buckets to the 21 degrees position, by turning the ballscrew driver (Ref. Fig. 301) (Detail B).

(2) Reinstall the access cover to the bucket ballscrew gearbox driver (Ref. Fig. 301) (Detail B) and torque-tighten the two bolts to 0,25 daN.m (20 to 25 lbf.in.).

(3) Install the access panels to the bucket ballscrew gearboxes. Torque the fitting screws to 0,60 daN.m (53 lbf.in.) using a pneumatic vibration screwdriver preadjusted at the required torquing value and equipped with an appropriate screwdriver head.

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.
USING MANUAL OR UNAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

(4) Reset all circuit breakers (Ref. Table 301).

BUCKET BALLSCREW GEARBOX - REMOVAL/INSTALLATION

1. General

This topic details the removal/installation of the bucket ball-screw gearboxes.

2. Removal/Installation of Bucket Ballscrew Gearbox

A. Equipment and Materials

DESCRIPTION	PART No.
Special wrench for rod end bearing	9970-511-043
R Extension	9970-515-296
Temporary connecting pin	9970-525-530
Torque wrench (0 to 3 daN.m range, 0 to 265 lbf in)	-
Pneumatic vibration screwdriver (pre adjusted at 0,60 daN.m 53 lbf in) and the appropriate screwdriver head	-
Pneumatic impact wrench (unscrewing mode) ARO 8530 PC1 and the appropriate screwdriver head.	
Circuit breaker safety clips	-

B. Prepare to Remove Bucket Ballscrew Gearbox (Ref. Fig. 401).

(1) Electrically isolate the engine and exhaust assembly services indicated in Table 401 by tripping the circuit breakers affecting engines in the nacelle upon which work is being carried out. Fit circuit breaker safety clips.

WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE ON WHICH THE REMOVAL IS CARRIED OUT.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENGINE No.1			
BUCKET CONT UNIT SUP	14-215	1K1132	E12
REV THRUST CONT	3-213	1K331	D 1

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENGINE No.2			
BUCKET CONT UNIT SUP	13-215	2K1132	G14
REV THRUST CONT	1-213	2K331	B 5
ENGINE No.3			
BUCKET CONT UNIT SUP	13-216	3K1132	C 6
REV THRUST CONT	1-213	3K331	B 6
ENGINE No.4			
BUCKET CONT UNIT SUP	14-216	4K1132	C 6
REV THRUST CONT	3-213	4K331	D 2

Circuit Breakers
Table 401

(2) Display a suitable placard on the engine starting panel, indicating that personnel are working on the engines and the twin secondary nozzle area.

(3) Remove the access panel to the ballscrew gearbox to be removed and remove the access panel to the Bucket pneumatic drive actuator, using pneumatic impact wrench equipped with an appropriate screwdriver head.

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD - USING MANUAL OR UNAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.
R BEFORE CARRYING OUT ANY WORK, THE SECONDARY
R NOZZLE MUST BE LINED WITH RUBBER CARPETS TO
R AVOID DAMAGE RESULTING FROM ACCIDENTAL
R BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES
R MUST ALSO BE WORN WHEN STEPPING ON THE
R NOZZLE.

(4) Remove the access cover to the ballscrew gearbox driver. (Ref. Fig. 401)(Detail B).

C. Removal of Bucket Ballscrew Gearbox. (Ref. Fig. 401).

(1) Using the appropriate extension, move the buckets to a position of 45 degrees approx., by turning the ballscrew gearbox driver (Ref. Fig. 401) (Detail B).

(2) Remove the bucket/ballscrew gearbox attaching bolt and replace it by the temporary connecting pin.

(a) Unlock and remove the castellated nut.

(b) Remove the attaching bolt and retain the two washers.

(c) Fit the temporary connecting pin.

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RB RB RB (3) Move the buckets to the zero degree position, hard against the ballscrew gearbox stops, and come back two turns toward the reverse position using the ballscrew gearbox driver.

(4) Manually lock the bucket pneumatic drive actuator in this position (0 degree + two turns towards reverse) (Ref. 78-33-06, Adjustment/Test).

(5) Disconnect the two flexible shafts from the ballscrew gearbox and eventually, if fitted, remove the shim.

(6) Remove the ballscrew gearbox front attaching bolt.

(a) Unlock and remove the castellated nut.

(b) Remove the attaching bolt and retain the two washers.

(7) Hold the ballscrew gearbox and remove the temporary connecting pin.

(8) Remove the ballscrew gearbox.

D. Prepare to Install Bucket Ballscrew Gearbox

(1) Smear all pins and bolts with lubricant S (Ref. 70-00-01).

(2) Fully retract the ballscrew gearbox against its stop position.

(3) Turn the Bucket Ballscrew gearbox driver two turns towards the reverse position.

NOTE: This two-revolution sequence corresponds to a deployment of the gearbox rod of 0.064 in (1.6 mm).

E. <u>Installation of the Bucket Ballscrew Gearbox</u>
(Ref. Fig.401 and 402)

(1) Position the ballscrew gearbox in the secondary nozzle and install the front attaching bolt complete with washer.

(2) Adjust the length of the ballscrew gearbox rod end bearing (Ref. Fig. 402) (Detail F).

<u>CAUTION</u>: IN THE COURSE OF THIS OPERATION, THE STOP ASSEMBLY MUST NOT ROTATE OUT OF THE ASRIGGED POSITION. THIS COULD LEAD TO SYSTEM DAMAGE.

(a) Cut the lockwire from lock-nut and lock-pin.

(b) Unscrew the lock-nut until the lock-pin is free, using the special wrench to hold the rod end bearing.

(c) Unscrew the rod end bearing by half=turns to approach the bucket attachment.

(i) If the rod end bearing centerline is slightly upstream of the bucket attachment mount centerline (zone A). (Ref. Fig. 402), unscrew the rod end bearing by an extra half turn before fitting the temporary connecting pin.

(ii) If the rod end bearing centerline is slightly downstream of the bucket attachment mount centerline (zone B). (Ref. Fig. 402). Fit the temporary connecting pin.

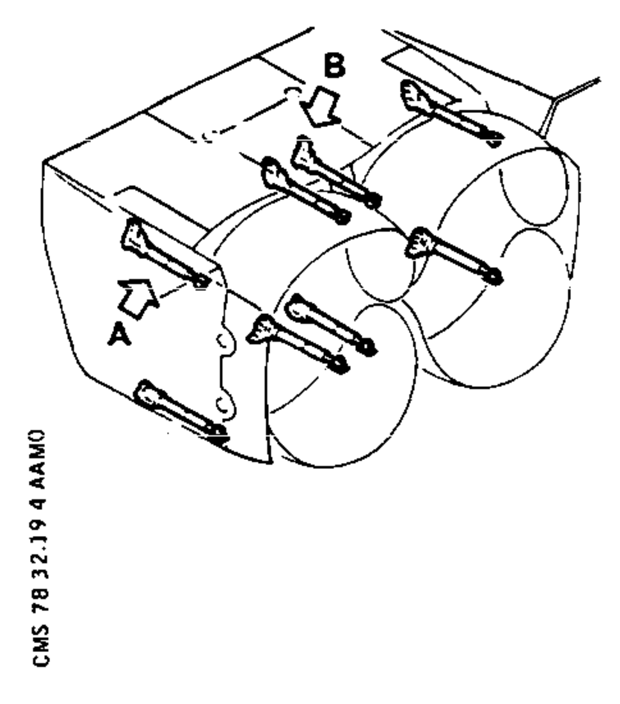
<u>NOTE</u>: If the two ballscrew gearboxes are changed on the same bucket. Refer to 78.31.01 Para E (10) to (14) for adjustment of the length of the ballscrew gearbox rod.

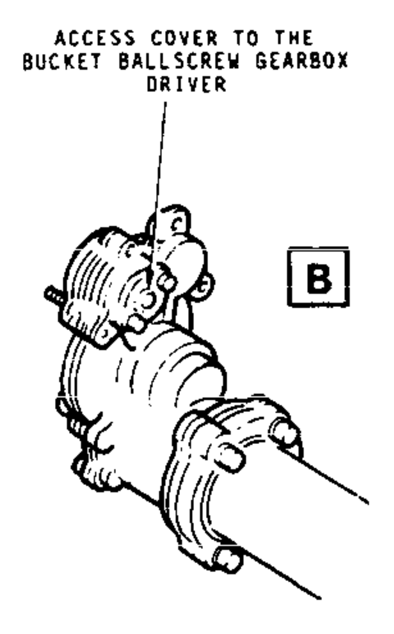
(d) Measure the maximum gap between the seal and the bucket leading edge.

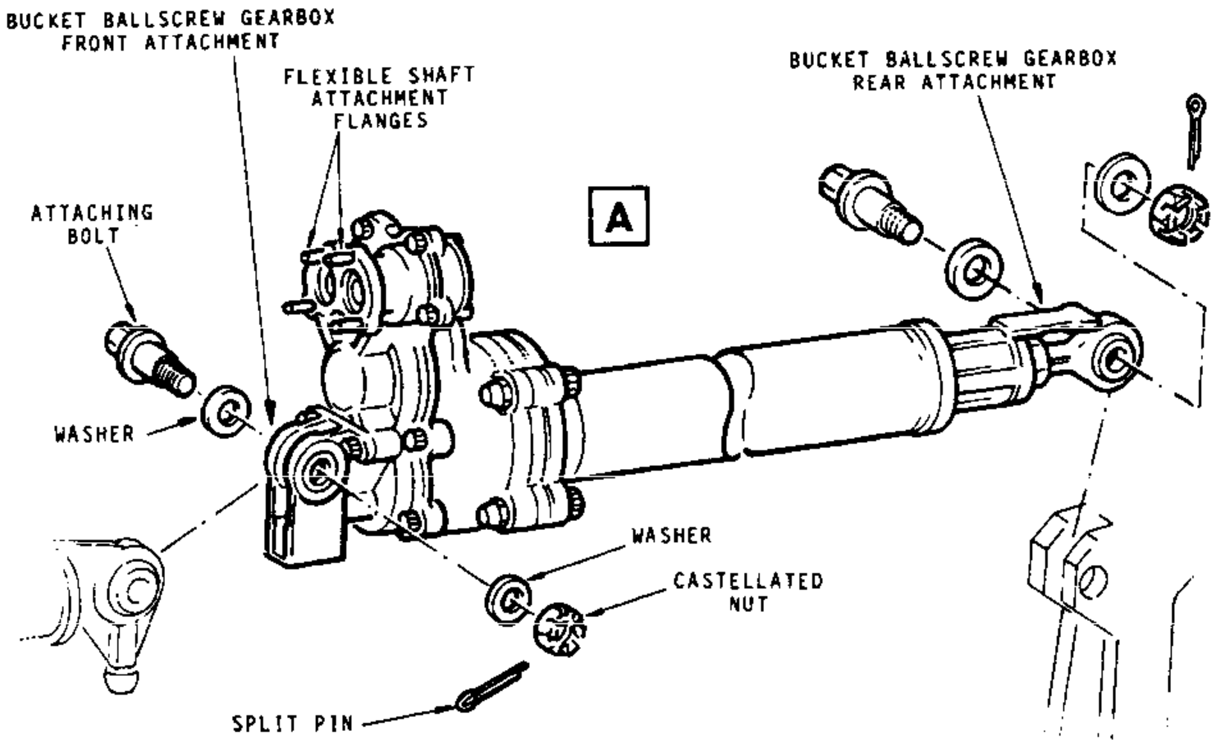
(i) If this gap is less than 2,5 mm (0.098 in), the adjustment is correct.

<u>CAUTION</u>: THE SEAL MUST NOT BE COMPRESSED.

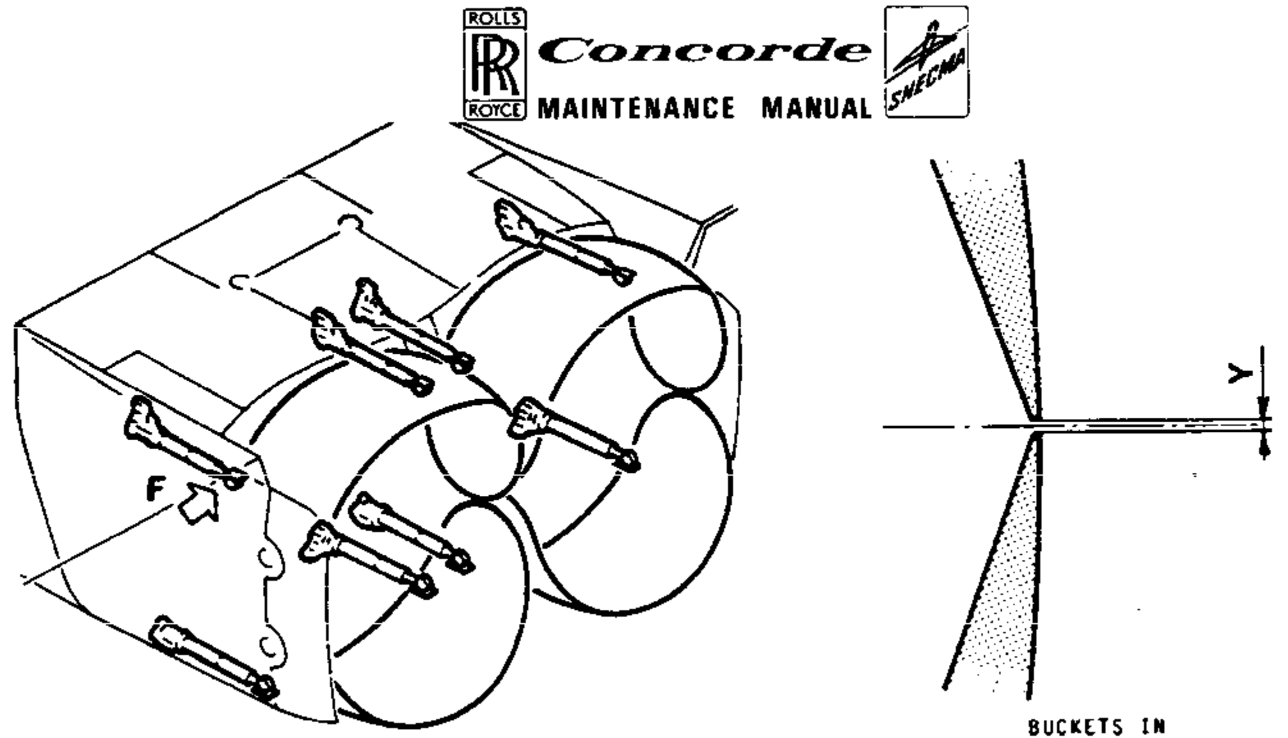
(ii) If this cap is greater than 2,5 mm (0.098 in) remove the temporary connecting pin, re-







Bucket Ballscrew Gearbox Removal
Figure 401



POSITION OF ROD END BEARING
UNSCREWED BY N HALF-TURNS

POSITION OF ROD END
BEARING UNSCREWED BY
N HALF-TURNS + 1 HALF-TURN

ZONE A

ZONE B

BUCKET ATTACHMENT MOUNT
CENTERLINE

BALLSCREW GEARBOX
DISPLACEMENT DIRECTION

POSITION DEFINED
BY ABUTMENT OF
BUCKET LEADING EDGE
ON THE SECONDARY NOZZLE
HEAT SHIELD SEAL

STOP
ASSEMBLY

F

WASHER

LOCK NUT

LOCK PIN

ROD END BEARING

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Bucket Ballscrew Gearbox Installation
Figure 402

screw the rod end bearing by only one half-turn and re-install the temporary connecting pin.

(e) Once the rod end bearing position is correctly adjusted, screw the lock-nut, making sure that the lock-pin is in correct position (Ref. Fig. 402) (Detail F). Use the special wrench to hold the rod end bearing.

(f) Torque tighten the lock-nut to 250 lbf in (2.8 mdaN).

(g) Wire-lock the lock-nut and lock-pin.

(3) Secure the ballscrew gearbox in its compartment (Ref. Fig. 401).

(a) On the front attaching bolt, install the washer and the castellated nut.

(b) Torque tighten the castellated nut between 90 to 100 lbf in (1 to 1.1 mdaN) and lock the nut with a split pin.

RB (4) Connect the flexible shafts (and eventually refit the
RB shims) to the ballscrew gearbox and torque tighten the
RB attaching bolts to 25 lbf in (0.30 mdaN)
RB (Ref. 78-34-01).

(5) Remove the manual lock on the bucket pneumatic drive actuator and place it on the "UNLOCKED" position (Ref. 78-33-06, Adjustment/Test).

(6) Move the buckets to a position close to 45 degrees.

(7) Remove the temporary connecting pin and secure the ballscrew gearbox rod end bearing to the bucket assembly.

(a) Install the rear attaching bolt complete with washers.

(b) Install the castellated nut and torque tighten between 95 to 110 lbf in (1.10 to 1.25 mdaN).

(c) Lock the nut with a split pin.

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F. Bucket Ballscrew Gearbox Installation Checks.

RB (1) Move the buckets to the zero position hard against the
RB ballscrew gearbox stops.

RB NOTE: If all four screwjacks do not fully retract to
RB their stops repeat the ballscrew gearbox
RB rigging procedure (Ref. 78-32-19 Para 2.C.).

(2) The buckets being in the zero degree position, check that there is no interference between the secondary nozzle structure, that is bearing the seal, and the bucket structure.

NOTE: If an interference between the secondary nozzle structure and the bucket structure is found, unscrew the rod end bearing of the two bucket ballscrew gearboxes driving the bucket by an extra half turn.

(3) Position the buckets at two intermediate positions between straight through flow and thrust reverse. At each of these points, check that drag torque does not exceed 17.5 lbf in (0.2 mdaN) (Ref. 78-30-00, Adjustment/Test).

(4) Check the gap Y between the buckets in 73 degrees position, ballscrews hard against stop. Y must be between 0.079 to 0.55 in (2 to 14 mm) (Ref. Fig. 402).

G. Final Installation

(1) Install the access cover to the bucket ballscrew gearbox driver (Ref. Fig. 401) (Detail B) and torque the two bolts to 25 lbf in (0.30 mdaN).

(2) Install the access cover to the bucket ballscrew gearbox and to the bucket pneumatic drive actuator. Torque the fitting screws to 53 lbf in (0.60 mdaN) using a pneumatic vibration screwdriver pre-adjusted at the required torquing value and equipped with an appropriate screwdriver head.

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD. USING MANUAL OR UNAPPRORIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

(3) Reset all circuit breakers (Ref. Table 401).

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BUCKET PNEUMATIC DRIVE ACTUATOR - REMOVAL/INSTALLATION

1. General

R R This topic details the removal/installation of the bucket pneumatic drive actuator (BPDA) as a whole unit.

CAUTION: IF REMOVAL AND INSTALLATION OF THE BUCKET PNEUMATIC DRIVE ACTUATOR IS GOING TO TAKE PLACE, THIS OPERATION MUST BE CARRIED OUT WITH THE SYSTEM LOCKED IN THE ZERO DEGREE POSITION.

2. Removal/Installation of Bucket Pneumatic Drive Actuator

A. Equipment and Materials

DESCRIPTION	PART NO.
Extension	9970-515-296
Torque wrench (0 to 3 mdaN range)	-
Pneumatic vibration screwdriver (pre-adjusted at 53 lbf in (0,60 mdaN) and the appropriate screwdriver head	-
Pneumatic impact wrench (unscrewing mode) ARO 8530 PC 1 and the appropriate screwdriver head	-
Circuit breaker safety clips	-

B. Prepare to Remove Bucket Pneumatic Drive Actuator (Ref. Fig.401).

(1) Electrically isolate the engine and exhaust assembly services indicated in Table 401 by tripping the circuit breakers affecting engines in the nacelle upon which work is being carried out. Fit circuit breaker safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINE No. 1			
BUCKET CONT UNIT SUP	14-215	1K1132	E12
REV THRUST CONT	3-213	1K331	D 1
ENGINE No. 2			
BUCKET CONT UNIT SUP	13-215	2K1132	G14
REV THRUST CONT	1-213	2K331	B 5
ENGINE No. 3			
BUCKET CONT UNIT SUP	13-216	3K1132	C 6
REV THRUST CONT	1-213	3K331	B 6
ENGINE No. 4			
BUCKET CONT UNIT SUP	14-216	4K1132	C 6
REV THRUST CONT	3-213	4K331	D 2

Circuit Breakers
Table 401

WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE ON WHICH THE REMOVAL IS CARRIED OUT.

(2) Display a suitable placard on the engine starting panel, indicating that personnel are working on the engine and twin secondary nozzle area.

(3) Using a pneumatic impact wrench equipped with an appropriate screwdriver head, remove the respective access panels to the bucket pneumatic drive actuator, and to the upper lateral ballscrew gearbox. (Ref. Fig.401).

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL
R ATTENTION TO THE SCREWDRIVER HEAD. USING MANUAL OR UNAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

BEFORE CARRYING OUT ANY WORK, THE SECONDARY NOZZLE MUST BE LINED WITH RUBBER CARPETS TO AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES MUST ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

(4) Place the buckets in the zero degree position and manually lock the pneumatic drive actuator (Ref. Adjustment/Test).

C. Removal of Bucket Pneumatic Drive Actuator (Ref. Figs.402 and 403).

<u>CAUTION:</u> THE NON-APPLICATION OF THIS DRILL MAY LEAD TO AN INADVERTENT MOVEMENT OF THE BUCKETS TOWARDS THE REVERSE POSITION.

(1) Disconnect the electrical connector as per recommendation Fig.404 Sheet 2 of 2.

(2) Disconnect both flexible shafts from pneumatic drive actuator. Remove the shims if fitted.

(3) Remove the telescopic tube and the P3 air supply elbow IAW 78-31-12 para.2.C.

(4) Remove the exhaust elbow (Ref. Fig.402, Detail B).

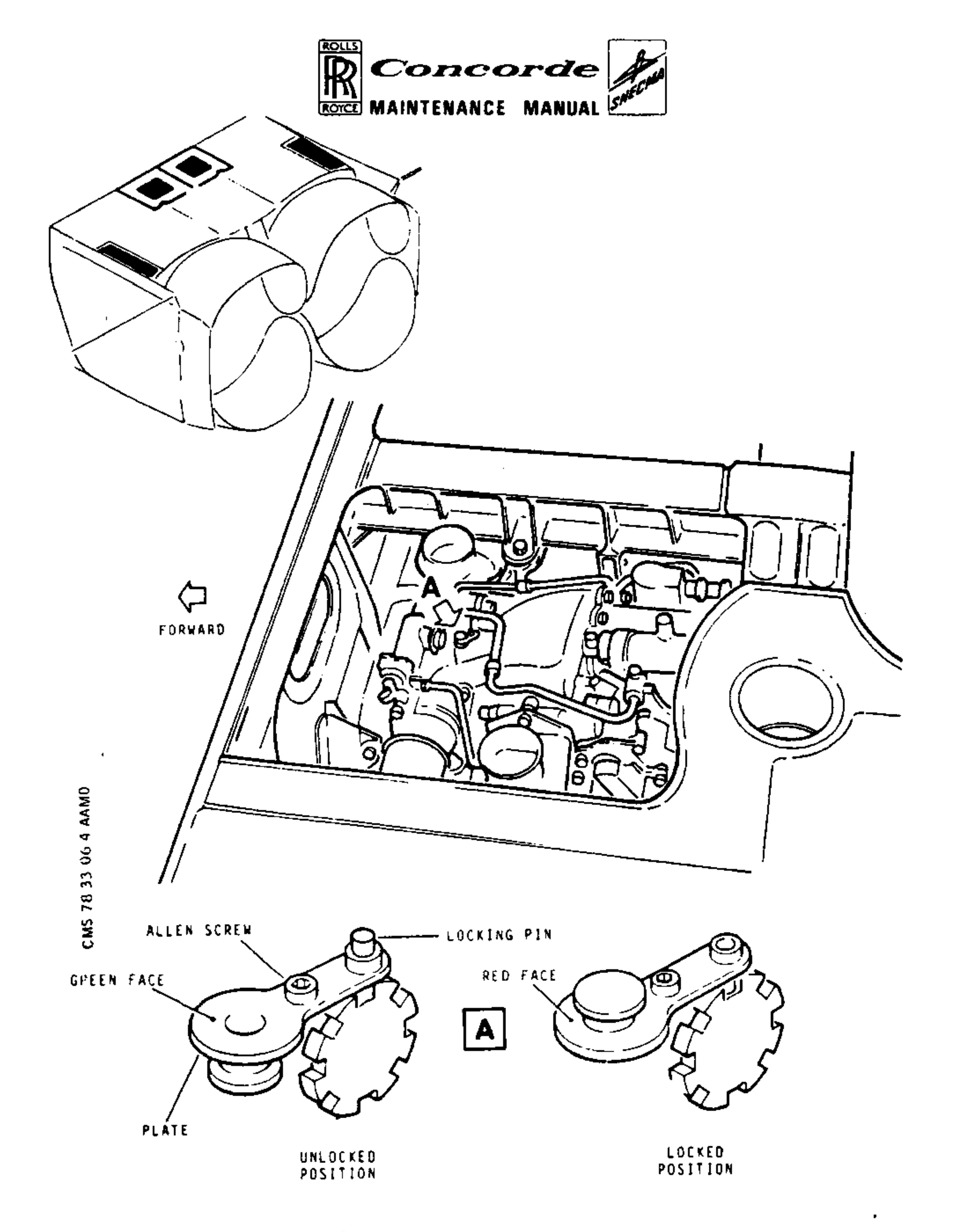
<u>NOTE:</u> This operation is applicable only when removing the pneumatic drive actuators fitted in bays No. 2 and 4.

(a) Remove the two self-locking nuts and retain the two flat washers.

(b) Remove the exhaust elbow.

<u>CAUTION:</u> EACH CONNECTING LINK IS SET TO A SPECIFIC LENGTH AND ALLOWS PROPER ALIGNMENT OF THE BPDA, P3 ELBOW SUPPLY PIPE AND TELESCOPIC TUBE, AND AVOIDS HOT AIR LEAKS.
EACH CONNECTING LINK MUST REMAIN IN ITS SPECIFIC BAY/POSITION AT ITS PRE-SET LENGTH.

(5) Remove the three pneumatic drive actuator attaching points (Ref. Fig.403).



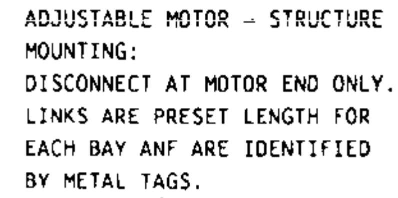
Preparation for Bucket Pneumatic Drive
Actuator Removal
Figure 401

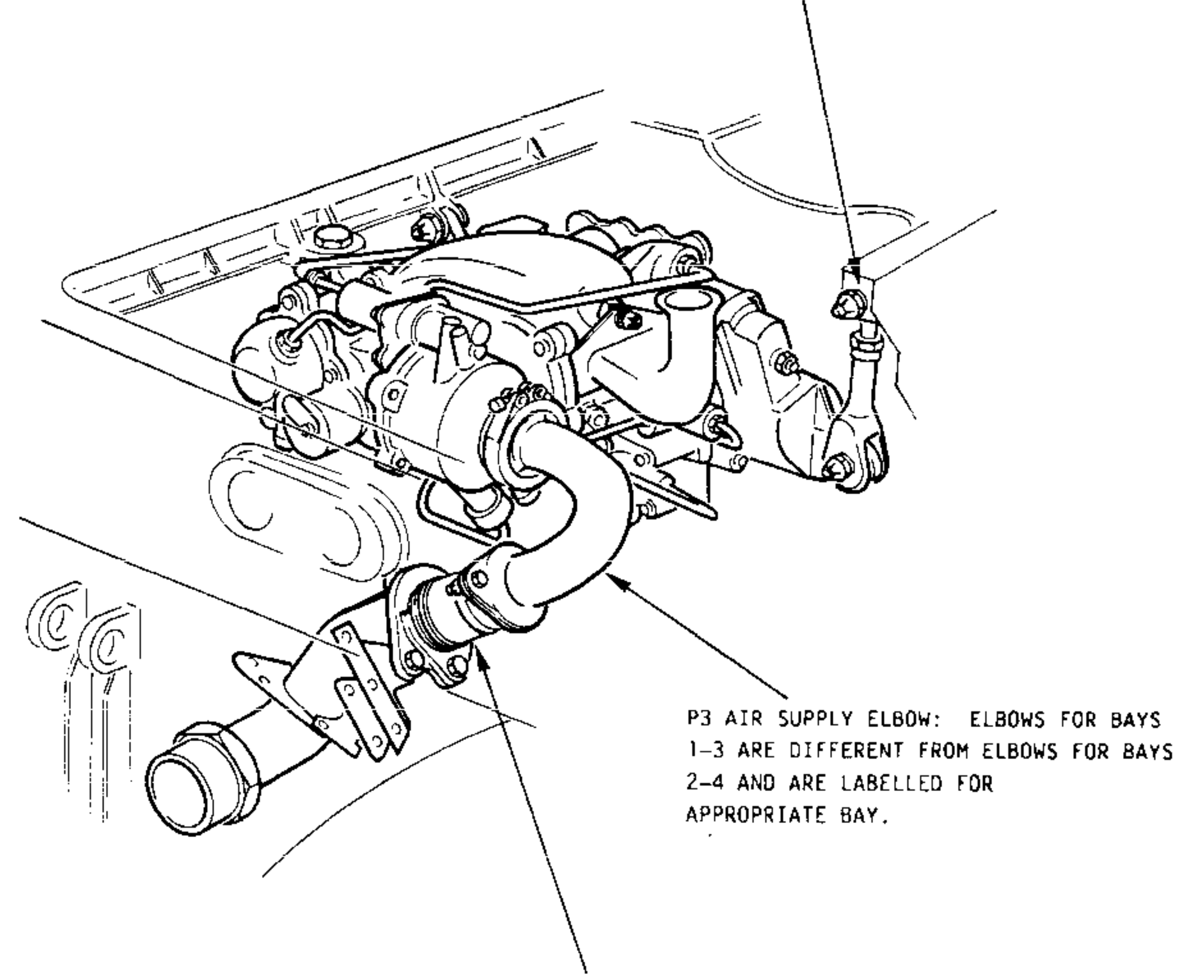
B
A
EXHAUST ELBOW
B

EXHAUST ELBOW
A
P3 AIR
SUPPLY ELBOW
TELESCOPIC TUBE

CMS 78 33 06 4 BAMO

Removal/Installation of Bucket Pneumatic
Drive Actuator
Figure 402 (Sheet 1 of 2)

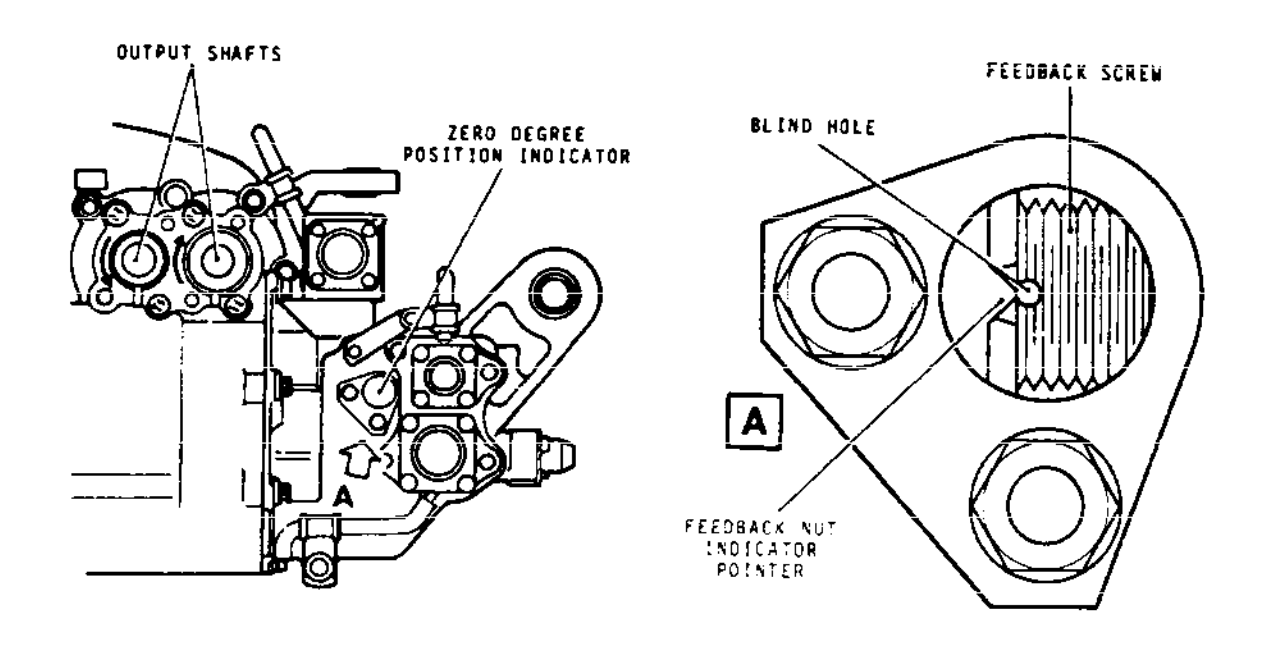


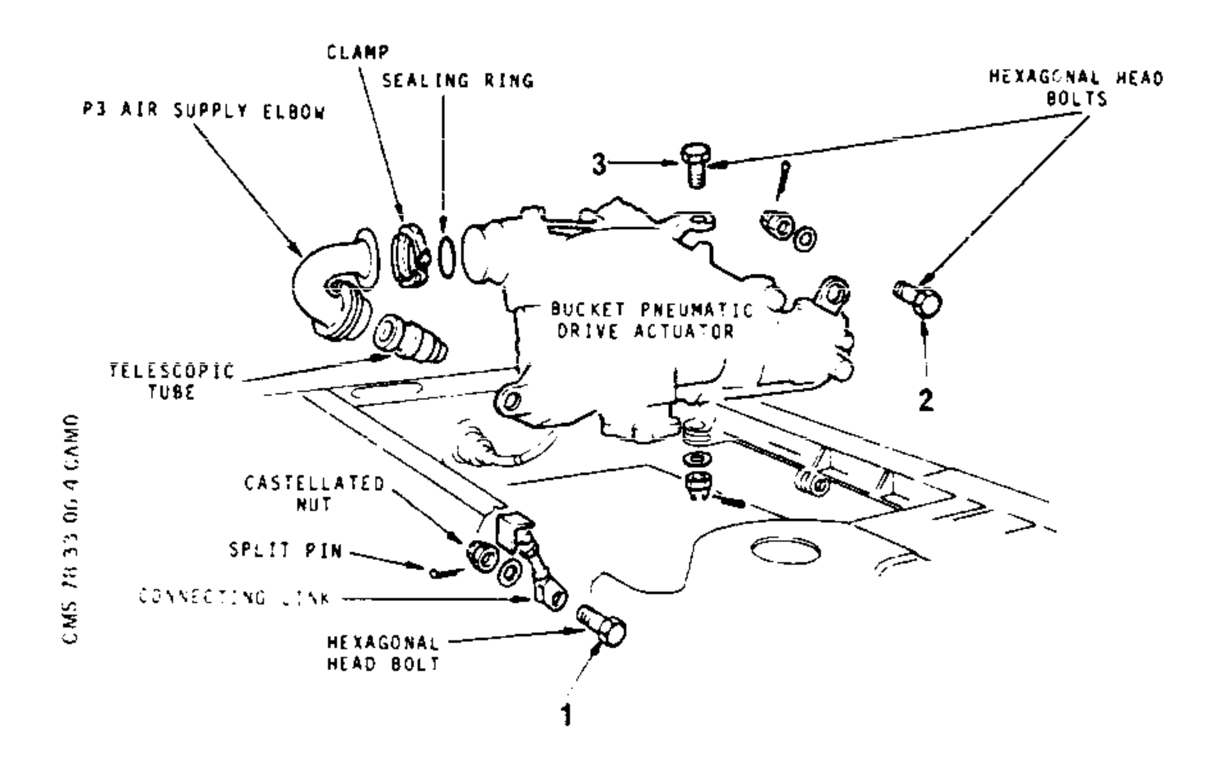


R B

Removal/Installation of Bucket Pneumatic
Drive Actuator
Figure 402 (Sheet 2 of 2)

R B





Setting and Installation of Bucket Pneumatic
Drive Actuator
Figure 403

R

(a) Remove the split pins, the castellated nuts and the hexagonal head bolts.

CAUTION: BE CAREFUL NOT TO LOSE THE BUSHINGS FITTED WITH THE CONNECTING ROD AND THE SUSPENSION YOKES OF THE BUCKET PNEUMATIC DRIVE ACTUATOR.

R (6) Remove the pneumatic drive actuator.

R (7) Remove the exhaust elbow fitted to the pneumatic drive actuator (Ref. Fig. 402, Detail A).

NOTE: This operation is applicable only when removing the pneumatic drive actuators fitted in bays No. 1 and 3.

(a) Remove the two self-locking nuts and retain the two flat washers.

(b) Remove the exhaust elbow.

D. Prepare to Install Pneumatic Drive Actuator

(1) Make sure the pneumatic drive actuator is locked in the zero degree position.

NOTE: The zero degree position is defined as the rotary position of the drive actuator required for the indicator pointer on the feedback nut to align both axially and rotationally with the
R indicator blind hole in the feedback screw
R (Ref. Fig.403, Detail A).

R (2) If it is not in the zero degree position, proceed as follows:

R (a) Remove the manual lock (Ref. Fig.401, Detail A).

(b) Rotate one of the drive actuator output shafts in the direction required to zero drive actuator indicator.

(c) Put the manual lock in "LOCKED" position.

(3) Make sure the buckets are at the zero degree hard against stop position.

(4) Fit the exhaust elbow to the pneumatic drive actuator (Ref. Fig.403, Detail A).

NOTE: This operation is applicable only when installing the pneumatic drive actuators in bays No. 1 and 3.

(a) Smear the two stud threads with lubricant S (Ref. 70-00-01).

(b) Position the exhaust elbow on the actuator.

(c) Install the two flat washers and the two self-locking nuts.

(d) Torque tighten the nuts from 25 to 28 lbf in (0.28 to 0.32 mdaN).

(5) Smear all pins and screws with lubricant S (Ref. 70-00-01).

CAUTION: FAILURE TO STRICTLY OBSERVE THE WHOLE BUCKET DRIVE PNEUMATIC ACTUATOR INSTALLATION PROCEDURE IN ITS ENTIRETY COULD RESULT IN EXTREMELY HOT AIR LEAKING INTO DRIVE BAY AREA CAUSING MALFUNCTION OF UNIT AND DISTRESS TO SURROUNDING STRUCTURE.

E. Installation of Bucket Pneumatic Drive Actuator (Ref. Fig.403)

(1) Position the pneumatic drive actuator in its housing.

<u>NOTE:</u> Taking the accessibility into consideration, it is recommended, in the case of engines 2 and 4, to tie the connecting link to a lockwire passing through the access door to the buckets drive unit position 1 or 3, and thus to place the connecting link in its final position.

<u>CAUTION:</u> BE CAREFUL NOT TO LOSE THE BUSHINGS FITTED WITH THE CONNECTION LINK AND THE SUSPENSION YOKES OF THE BUCKET PNEUMATIC DRIVE ACTUATOR.

(2) Secure the pneumatic drive actuator in position.

(a) Install the three hexagonal head bolts, washers and castellated nuts.

(b) Torque the attaching bolt (1) to between 160 and 180 lbf in (1.8 and 2 mdaN).

(c) Torque the attaching bolt (2) to between 50 and 60 lbf in (0.56 and 0.68 mdaN).

(d) Torque the attaching bolt (3) to between 160 and 180 lbf in (1.8 and 2 mdaN).

(3) Fit the exhaust elbow to the pneumatic drive actuator (Ref. Fig.402, Detail B).

<u>NOTE:</u> This operation is applicable only when installing the pneumatic drive actuators in bays No. 2 and 4.

(a) Position the exhaust elbow on the actuator.

(b) Install the two flat washers and the two self-locking nuts.

(c) Torque tighten the nuts from 0,28 to 0,32 mdaN (25 to 28 lbf in).

(4) Install the telescopic tube and the P3 air supply elbow IAW 78-31-12, para.2.D.

(5) Remove the manual lock and place it in the "UNLOCKED" position (Ref. Fig.401, Detail A).

(6) Connect the flexible shafts to the bucket pneumatic drive actuator and torque tighten the attaching bolts to 25 lbf in (0,3 mdaN). Re-install the shims if removed in operation (2), para.C.

<u>NOTE:</u> It will be necessary to rotate the drive unit output shaft plus or minus 30 degrees to engage the hexagonal end of flexible shafts.

(7) Connect the electrical connectors, then wire lock the plugs IAW Fig.404, Sheet 2 of 2.

<u>NOTE:</u> Due to the particularly hostile environment in which the pneumatic drive actuator operates, it is essential that the electrical connectors are checked for contamination and serviceability prior to connection to the actuator. Failure to do so may result in incorrect operation and engine shut-down.

(8) Carry out the telescopic tube air leak check IAW 78-31-12, para.2.A-B-C-D and the bucket control system operational test as detailed in 78-00-00 (Page 501, Para.2.A-B-D-E-F-G).

<u>NOTE:</u> As cautioned in 78-00-00, Adjustment/Test para.2.G. (4), pay particular attention to re-blanking the ground test connector pipe closure nut.

F. Final Installation

(1) Replace the access cover to the bucket ballscrew gearbox driver and torque the two bolts to 25 lbf in (0,3 mdaN).

(2) Install the access panels to the bucket pneumatic drive actuator and to the upper lateral ballscrew gearbox.

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD. USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO DETERIORATION OF THE SCREWS.

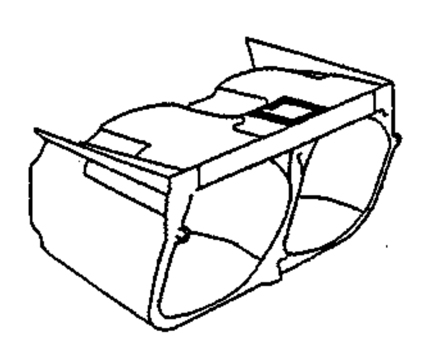
R (3) Torque the fitting screws to 53 lbf in (0,60 mdaN) using a pneumatic vibration screwdriver pre-adjusted at the required torquing value and equipped with an appropriate screwdriver head.

R G. Conclusion

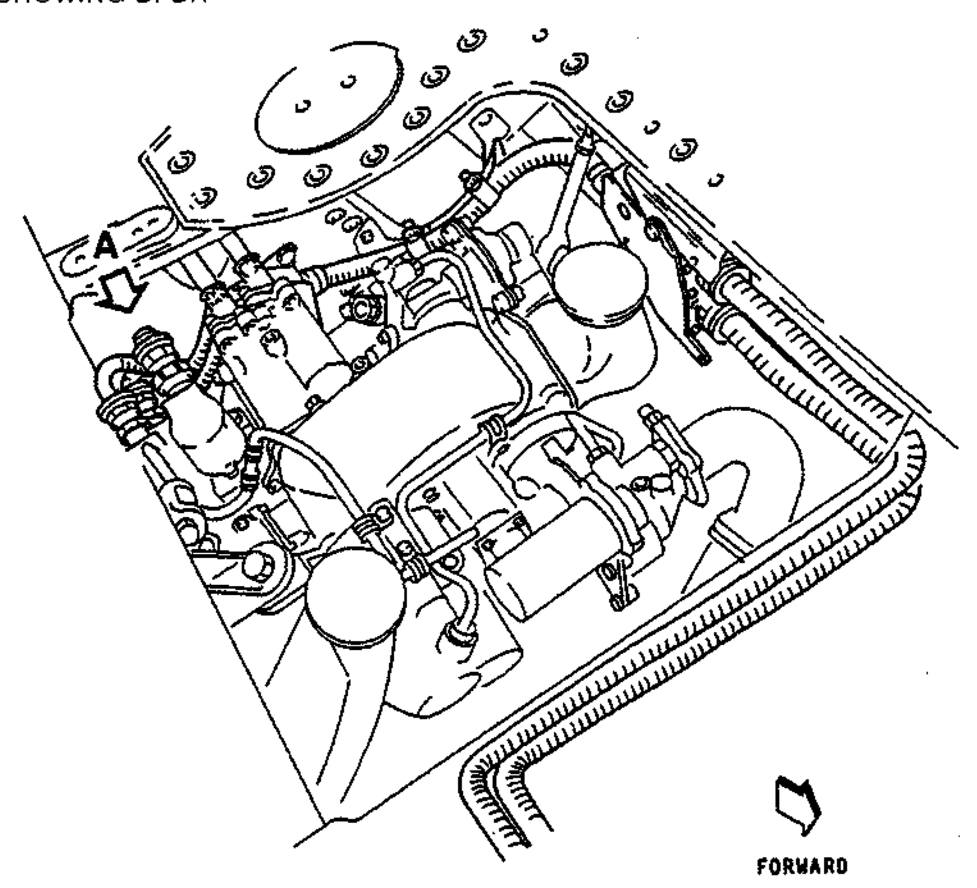
R (1) Install the access panel to the bucket pneumatic drive
R actuator.

R CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL
R ATTENTION TO THE TYPE AND CONDITION OF THE
R SCREWDRIVER HEAD. USING MANUAL OR
R INAPPROPRIATE TOOLS COULD ONLY LEAD TO THE
R DETERIORATION OF THE SCREWS.

R (2) Torque the fitting screws to 53 lbf in (0,60 mdaN).
R using a pneumatic vibration screwdriver pre-adjusted
R at the required torquing value and equipped with an
R appropriate screwdriver head.



VIEW OF BPDA COMPARTMENT
SHOWING BPDA



REVERSE CONTROL SYSTEM
OVERHEATING OF THESE COMPONENTS MAY PROVOKE
INADVERTENT MOVEMENTS TOWARD REVERSE POSITION

R Removal/Installation - Bucket Pneumatic Drive Actuator
R Figure 404 (Sheet 1 of 2)

BS00032268/2



FOR EQUIPMENT REMOVAL/INSTALLATION:

EQUIPMENT

THIS NUT TO BE LOOSENED OFF AND LOCKWIRE REPLACED AFTER INSTALLATION

THIS NUT NOT TO BE SLACKENED ENSURE THAT THE LOCKWIRE IS STILL IN PLACE

CONNECTOR

THESE LOCKWIRES ARE NOT TO BE CUT DURING REMOVAL/INSTALLATION OF EQUIPMENT ITEMS

REVERSE CONTROL SYSTEM
OVERHEATING OF THESE COMPONENTS MAY PROVOKE INADVERTENT MOVEMENTS TOWARD REVERSE POSITION

R Removal/Installation - Bucket Pneumatic Drive Actuator
R Figure 404 (Sheet 2 of 2)

BUCKET PNEUMATIC DRIVE ACTUATOR - ADJUSTMENT/TEST

1. General

The procedures described in this chapter are only applicable for removal of the bucket control system components. The procedure used to lock the bucket pneumatic drive actuator at 0° should be made use of when removal of the buckets flexible shafts, bucket position transmitter (indicator) or removal of the bucket pneumatic drive actuator itself is going to be carried out.

The procedure used to lock the bucket pneumatic drive actuator at "0° + 2 turns" is only made when removing the bucket ballscrew gearboxes and buckets.

2. Locking the Reverse System, Buckets in 0 Deg. Position

NOTE: This operation is only applied before removing bucket pneumatic drive actuator, bucket position transmitter (Indicator), and flexible shafts.

A. Equipment and Materials

DESCRIPTION	PART No.
R Extension	9970-515-296
Pneumatic vibration screw-driver (pre-adjusted at 0,60 daN.m 53 lbf.in and the appropriate screwdriver head.	
Pneumatic impact wrench (unscrewing mode) ARO 8530 PC1 and the appropriate screwdriver head.	
Circuit breaker safety clips	-

B. Preparation

(1) Electrically isolate the engine and exhaust assembly services indicated in Table 501 by tripping the circuit breakers affecting engines in the nacelle upon which work is being carried out.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENGINE No. 1			
ENG 1 BUCKET CONT UNIT SUP	14-215	1K1132	E12
ENG 1 REV THRUST CONT	3-213	1K331	D 1
ENGINE No. 2			
ENG 2 BUCKET CONT UNIT SUP	13-215	2K1132	G14
ENG 2 REV THRUST CONT	1-213	2K331	B 5
ENGINE No. 3			
ENG 3 BUCKET CONT UNIT SUP	13-216	3K1132	C 6
ENG 3 REV THRUST CONT	1-213	3K331	B 6
ENGINE No. 4			
ENG 4 BUCKET CONT UNIT SUP	14-216	4K1132	C 6
ENG 4 REV THRUST CONT	3-213	4K331	D 2

Circuit Breakers
Table 501

WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE ON WHICH THE WORK IS CARRIED OUT.

(2) Display a suitable placard on the engine starting panel, indicating that personnel are working in the engine and twin secondary nozzle area.

C. Position the Buckets at 0 Deg.

(1) Remove the access panel to the upper lateral ballscrew gearbox, using a pneumatic impact wrench equipped with an appropriate screwdriver head.

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.
USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO DETERIORATION OF THE SCREWS.
R BEFORE CARRYING OUT ANY WORK, THE SECONDARY

R NOZZLE MUST BE LINED WITH RUBBER CARPETS TO
R AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS
R OR SCRATCHES. A LIGHT PAIR OF SHOES MUST
R ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

(2) Remove the access cover to the ballscrew gearbox driver (Ref. Fig. 501) (Detail B).

(3) Using the appropriate extension, move the buckets to the 0 Deg. position, hard against the stop, by turning the ballscrew gearbox driver (Ref. Fig. 501) (Detail B).

D. Locking the Pneumatic Drive Actuator (Ref. Fig. 502)

(1) Remove the access panel to the bucket pneumatic drive actuator, using the pneumatic impact wrench equipped with an appropriate screwdriver head.

<u>CAUTION</u>: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.
USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO DETERIORATION OF THE SCREWS.

(2) Unscrew and remove the "Allen" screw securing the locking plate to the pneumatic drive actuator.

(3) Turn the plate over and reposition it on the pneumatic drive actuator, ensuring that the locking pin is correctly engaged in the toothed wheel (Ref. Fig. 502) (Detail A).

<u>NOTE</u>: It will be necessary to rotate the drive actuator output shaft plus or minus 30 degrees from the zero-degree position to engage the manual lock. This will be needed to ensure that the manual lock is inserted exactly between two teeth of the gear in the housing.

<u>CAUTION</u>: FAILURE TO POSITION THE GEAR PROPERLY FOR INSTALLATION OF THE MANUAL LOCK MAY RESULT IN DAMAGE TO THE UNIT.

(4) Screw and tighten the plate attaching bolt.

E. Unlocking the Bucket Pneumatic Drive Actuator.

(1) Unscrew and remove the "Allen" screw securing the locking plate to the pneumatic drive actuator.

A

BUCKET

X

ROD END
BEARING

BALLSCREW GEARBOX

B

ACCESS COVER

B

ACCESS
COVER

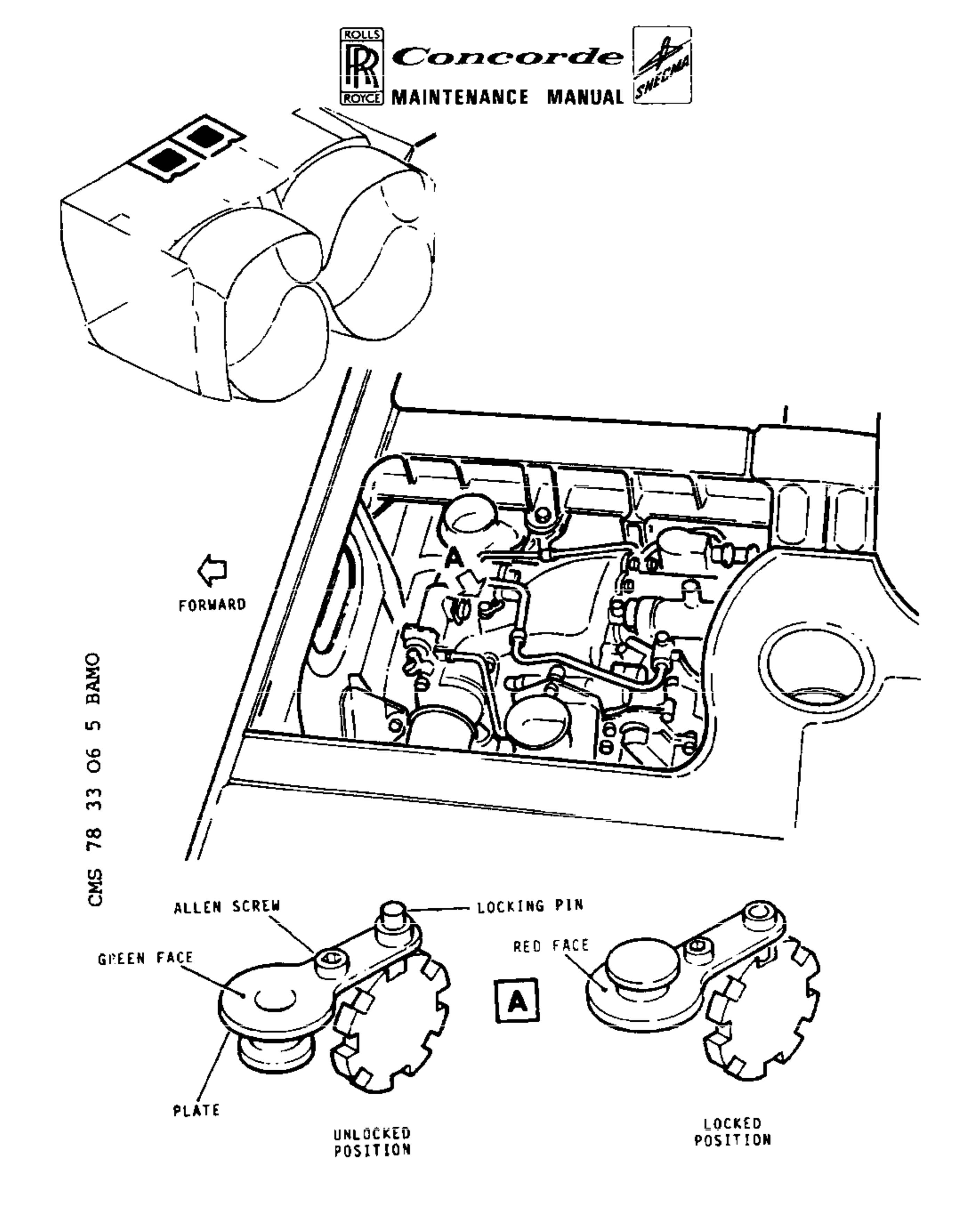
JACK DRIVER

BUCKET BALLSCREW
GEARBOX

CMS 78 33 06 5 AAN10

Positioning the Buckets to an angle of
Zero Degrees
Figure 501

R



Locking the Bucket Pneumatic Drive Actuator
Figure 502

(2) Turn the plate over and reposition it on the pneumatic drive actuator ensuring that the locking pin is visible on the top of the plate (Ref. Fig. 502) (Detail A).

(3) Screw and tighten the plate attaching bolt.

(4) Install the access panel to the bucket pneumatic drive actuator and torque the fitting screws to 0.60 daN.m (53 lbf.in) using a pneumatic vibration screwdriver pre-adjusted at the required torquing value and equipped with an appropriate screwdriver head.

<u>CAUTION</u>: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.
R USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO DETERIORATION OF THE SCREWS.
R BEFORE CARRYING OUT ANY WORK, THE SECONDARY
R NOZZLE MUST BE LINED WITH RUBBER CARPETS TO
R AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS
R OR SCRATCHES. A LIGHT PAIR OF SHOES MUST
R ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

F. Conclusion

(1) Using the appropriate extension, bring back the buckets to the 21 degrees position, by turning the ballscrew gearbox driver. The relevant bucket jack stroke X must be within 76 and 96 mm (3.0 in. and 3.7 in. (Ref. Fig. 502, Detail A).

(2) Replace the access cover to the bucket ballscrew gearbox driver and torque tighten the two bolts to 0.30 daN.m (25 lbf. in.).

(3) Reinstall the access panel to the ballscrew gearbox and torque tighten the fitting screws to 0.60 daN.m (53 lbf. in.) using a pneumatic vibration screwdriver pre-adjusted at the required torquing value and equipped with an appropriate screwdriver head.

<u>CAUTION</u>: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD. USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO DETERIORATION OF THE SCREWS.

(4) Remove the circuit breaker safety clips, and reset

the circuit breakers (Ref. Table 502).

3. Locking of the Reverser System, Buckets at 0° + 2 turns towards reverse.

NOTE: This operation is only applied during removal and installation of bucket ballscrew gearboxes and buckets.

WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE ON WHICH THE WORK IS CARRIED OUT.

A. Equipment and Materials

	DESCRIPTION	PART NO.
R	Extension	9970-515-296
	Pneumatic vibration screwdriver (pre-adjusted at 0,60 daN.m 53 lbf.in) and the appropriate screwdriver head.	
	Pneumatic impact wrench (unscrewing mode) ARO 8530 PC1 and the appropriate screwdriver head.	
	Circuit breaker safety clips	-

B. Preparation.

(1) Electrically isolate the engine and exhaust assembly services indicated in Table 502 by tripping the circuit breakers affecting engines in the nacelle upon which work is being carried out.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINE No.1			
BUCKET CONT UNIT SUP	14.215	1K1132	E12
REV THRUST CONT	3.213	1K331	D 1

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINE No.2			
BUCKET CONT UNIT SUP	13.215	2K1132	G14
REV THRUST CONT	1.213	2K331	B 5
ENGINE No.3			
BUCKET CONT UNIT SUP	13.216	3K1132	C 6
REV THRUST CONT	1.213	3K331	B 6
ENGINE No.4			
BUCKET CONT UNIT SUP	14.216	4K1132	C 6
REV THRUST CONT	3.213	4K331	D 2

Circuit Breakers
Table 502

(2) Display a suitable placard on the engine starting panel, indicating that personnel are working in the engine and firing secondary nozzle area.

C. Position the Buckets at 0° + 2 turns towards reverse.

(1) Remove the access panel to the upper lateral ballscrew gearbox, using a pneumatic impact wrench equipped with an appropriate screwdriver head.

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.
USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO DETERIORATION OF THE SCREWS
R BEFORE CARRYING OUT ANY WORK, THE SECONDARY
R NOZZLE MUST BE LINED WITH RUBBER CARPETS TO
R AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS
R OR SCRATCHES. A LIGHT PAIR OF SHOES MUST
R ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

(2) Remove the access cover to the ballscrew gearbox driver. (Ref. Fig. 501) (Detail B).

(3) Using the appropriate extension and turning the gearbox driver (Ref. Fig. 501) (Detail B), move the buckets to the zero degrees position, hard against the stop and come back two turns towards the reverse position. Gear box stroke X = 1.6 mm

(0.064 in) (Ref. Fig. 501) (Detail A).

D. Locking the Bucket pneumatic drive actuator.

(1) Remove the access panel to the bucket pneumatic drive actuator using a pneumatic impact wrench equipped with an appropriate screwdriver head.

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.
USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO DETERIORATION OF THE SCREWS.
R BEFORE CARRYING OUT ANY WORK, THE SECONDARY
R NOZZLE MUST BE LINED WITH RUBBER CARPETS TO
R AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS
R OR SCRATCHES. A LIGHT PAIR OF SHOES MUST
R ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

(2) Unscrew and remove the "Allen" screw securing the locking plate to the pneumatic drive actuator.

(3) Turn the plate over and reposition it on the pneumatic drive actuator, ensuring that the locking pin is correctly engaged in the toothed wheel (Ref. Fig. 502) (Detail A).

NOTE: It will be necessary to rotate the drive actuator output shaft plus or minus 30 degrees from the zero degrees + 2 turns position to engage the manual lock. This will be needed to ensure that the manual lock is inserted exactly between two teeth of the gear in the housing.

CAUTION: FAILURE TO POSITION THE GEAR PROPERLY FOR INSTALLATION OF THE MANUAL LOCK MAY RESULT IN DAMAGE TO THE UNIT.

(4) Screw and tighten the plate attaching bolt.

E. Unlocking the Bucket Pneumatic Drive Actuator.

(1) Unscrew and remove the "Allen" screw securing the locking plate to the pneumatic drive actuator.

(2) Turn the plate over and reposition it on the pneumatic drive actuator ensuring that the locking pin is visible on the top of the plate (Ref. Fig. 502) (Detail A).

(3) Screw and tighten the plate attaching bolt.

(4) Install the access panel to the bucket pneumatic drive actuator and torque the fitting screws to 0.60 daN.m (53 lbf.in) using a pneumatic vibration screwdriver pre-adjusted at the required torquing value and equipped with an appropriate screwdriver head.

<u>CAUTION:</u> USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITIONS OF THE SCREWDRIVER HEAD.
USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO DETERIORATION OF THE SCREWS.

F. Conclusion

(1) Using the appropriate, extension, bring back the buckets to the 21 degrees position, by turning the ballscrew gearbox driver. The relevant bucket jack stroke X must be within 76 and 96 mm (3.0 and 3.7 in.) (Ref. Fig. 501, Detail A).

(2) Replace the access cover to the bucket ballscrew gearbox driver and torque tighten the two bolts to 0.30 daN.m (25 lbf. in.).

(3) Reinstall the access panel to the ballscrew gearbox and torque tighten the fitting screws to 0.60 daN.m (53 lbf. in) using a pneumatic vibration screwdriver pre-adjusted at the required torquing value and equipped with an appropriate screwdriver head.

<u>CAUTION:</u> USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.
USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO DETERIORATION OF THE SCREWS.

(4) Remove the circuit breaker safety clips, and reset the circuit breakers (Ref. Table 502).

BUCKETS FLEXIBLE SHAFTS - SERVICING

1. General

Bucket Flexible Shafts must be relubricated.

Lubrication at field service level is accomplished by removing the flexible shaft from its casing and by installing a replacement lubricated flexible shaft.

Lubrication (relubrication) of the flexible shaft itself shall be accomplished at overhaul facilities.

CAUTION: REMOVAL AND INSTALLATION OF THE BUCKETS FLEXIBLE SHAFTS SHOULD BE CARRIED OUT WITH THE SYSTEM LOCKED IN THE ZERO DEGREE POSITION.

2. Removal/Installation of the Flexible Shafts

A. Equipment and Materials

	DESCRIPTION	PART NO.
R	Extension	9970-515-296
	Special wrench	852-500-149-0
	Torque wrench (0 to 3 daN.m in range (0 to 22 lbf.ft,in range	
	Circuit breaker safety clips	
	Pneumatic vibration screwdriver (Pre-adjusted at 0.60 daN.m = 53 lbf.in) and the appropriate screwdriver head.	
	Pneumatic impact wrench (unscrewing mode) ARO 8530 PC 1 and the appropriate screwdriver head.	

B. Prepare to Remove the Flexible Shafts.

(1) Electrically isolate the engine and exhaust assembly services indicated in Table 301 by tripping the circuit breakers affecting engines in the nacelle upon which work is being carried out.

WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE TWIN SECONDARY NOZZLE ON WHICH THE REMOVAL IS CARRIED OUT.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINE No. 1			
BUCKET CONT UNIT SUP	14-215	1K1132	E12
REV THRUST CONT	3-213	1K331	D 1
ENGINE No. 2			
BUCKET CONT UNIT SUP	13-215	2K1132	G14
REV THRUST CONT	1-213	2K331	B 5
ENGINE No. 3			
BUCKET CONT UNIT SUP	13-216	3K1132	C 6
REV THRUST CONT	1-213	3K331	B 6
ENGINE No. 4			
BUCKET CONT UNIT SUP	14-216	4K1132	C 6
REV THRUST CONT	3-213	4K331	D 2

Circuit Breakers
Table 301

(2) Display a suitable placard on the engine starting panel, indicating that personnel are working on the engines and in the twin secondary nozzle area.

(3) Using a pneumatic impact wrench equipped with an appropriate screwdriver head, remove the bucket pneumatic drive actuator and the two lower bucket ball-screw gearboxes access panels (Ref. Fig. 301).

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.
USING MANUAL OR UNAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

BEFORE CARRYING OUT ANY WORK, THE SECONDARY
R NOZZLE MUST BE LINED WITH RUBBER CARPETS
TO AVOID DAMAGE RESULTING FROM ACCIDENTAL
BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES
R MUST ALSO BE WORN WHEN STEPPING ON THE

(4) Using the driver of one of the lower ballscrew gearboxes, move the buckets to the zero degree position and lock the pneumatic drive actuator in that position (Ref. 78-33-06, Adjustment/Test).

C. Removal of the Flexible Shafts.

(1) Remove the fitting bolts and nuts securing the flexible shafts casing to the bucket pneumatic drive actuator and to the lower bucket ballscrew gearboxes.

(2) If shims are used, make a note of their thickness and position (Ref. Fig. 301).

(3) Disconnect the flexible shafts and their casings from the bucket pneumatic drive actuator and from the bucket ballscrew gearboxes (Ref. Fig. 301).

(4) Remove the flexible shafts by pulling them out of their casings.

NOTE: Difficulties can be encountered when pulling out the flexible shafts, deconnecting them at both ends should improve the situation.

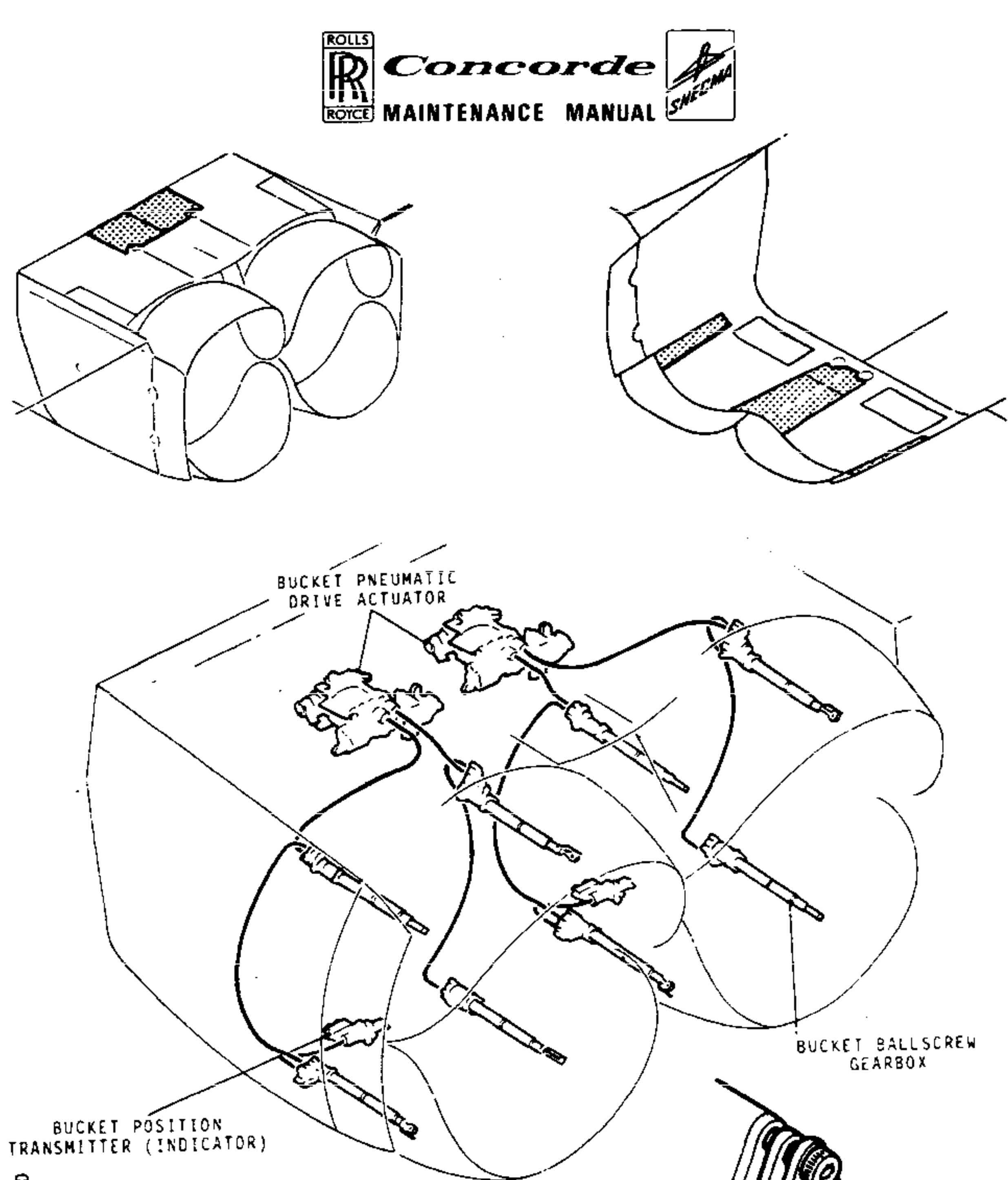
CAUTION: DURING TRANSPORT AND INSTALLATION/REMOVAL OR DURING STORAGE THE FLEXIBLE SHAFTS SHOULD BE KEPT IN A STRAIGHT POSITION. IF THIS CONDITION CAN NOT BE FOLLOWED DUE TO SOME OPERATIONAL REASON IT WILL BE POSSIBLE TO ROLL THE FLEXIBLE SHAFTS MAKING SURE TO RESPECT A MINIMUM BEND RADIUS OF 610 mm (24 inches) FAILURE TO DO SO COULD LEAD TO SYSTEM DAMAGE.

D. Installation of the Flexible Shafts

R (1) Smear all pins and screws with lubricant S (Ref. 70-00-01).

(2) Install the flexible shafts by inserting and pushing them through their casings until the core hexagonal drive ends are properley engaged into the upper bucket ballscrew gearboxes and into the bucket position transmitter (Indicator).

NOTE: It may be necessary to rotate the core hexagonal drive end by plus or minus 30 degrees, using the appropriate wrench.



R Buckets Flexible Shafts - Servicing
Figure 301

R Difficulties can be encountered when pushing the flexible shafts into their casings, disconnecting them at both ends should improve the situation.

(3) Reinstall the shims at their respective position as found during removal (Ref. Fig. 301).

(4) Insert the core hexagonal drive ends in the bucket pneumatic drive actuator and in the lower bucket ballscrew gearboxes.

NOTE: It may be necessary to rotate the core hexagonal drive end by plus or minus 30 degrees, using the appropriate wrench.

(5) Connect and secure the flexible shaft casings to the bucket pneumatic drive actuator and to the lower bucket ballscrew gearboxes.

(6) Check the routing of the flexible shaft casings as described in 78-34-01 Removal/Installation.

(7) Torque the fitting bolts and nuts securing the flexible shaft casings to the bucket pneumatic drive actuator and to the lower buckets ballscrew gearboxes to 0,30 daN.m (25 lbf.in.).

E. Operational Test

Carry out the bucket control operational test as detailed in Chapter 78-00-00, Adjustment/Test, page 501, paragraph 2. A - B E operations (1) and (2).

NOTE: Before carrying out this test, unlock the pneumatic drive actuator (Ref. 78-33-06, Adjustment/Test) and reset the circuit breakers (Ref. Table 301).

F. Final Installation

R (1) Disconnect the compressed air supply hose from the ground
R test connector.

R (2) Install the pipe closure nut on the ground test connector;
R torque to 3,5 daN.m (25.81 lb.ft) and safety with lockwire
R (Ref. 20-21-13).

R CAUTION: FAILURE TO CORRECTLY REPLACE AND SECURE THE PIPE
R CLOSURE NUT COULD RESULT IN HOT AIR LEAKAGE WITH
R CONSEQUENT DAMAGE TO ADJACENT WIRING LOOMS AND
R COMPONENTS.

R (3) Install the relevant access panels. Torque the fitting screws to 0,60 daN.m (53 lbf.in.) using a pneumatic vibration screwdriver pre-adjusted at the required torque value and equipped with an appropriate screwdriver head.

R CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.

USING MANUAL OR UNAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

BUCKET FLEXIBLE SHAFTS - REMOVAL/INSTALLATION

1. General

Each reverse system incorporates five flexible shafts which transmit the bucket pneumatic drive actuator output power to the ballscrew gearboxes. This chapter details the removal/installation of all flexible shafts, taking in account that each flexible shaft can be removed individually.

CAUTION: REMOVAL AND INSTALLATION OF THE BUCKET FLEXIBLE SHAFTS SHOULD BE CARRIED OUT WITH THE SYSTEM LOCKED IN THE ZERO DEGREE POSITION.

2. Removal/Installation of Bucket Flexible Shafts

A. Equipment and Materials

DESCRIPTION	PART No.
Flexible shaft Clamp-support	852-500-046-0
Special wrench	852-500-149-0
Flexible Shaft Installing device	852-500-044-0
Torque wrench	(0 to 3daN.m in range) (0 to 22 lb.ft,in range)
Pneumatic vibration screwdriver (pre-adjusted at 0.60 daN.m) and the appropriate screwdriver head. Pneumatic impact wrench (unscrewing mode) ARO 8530 PC 1 and the appropriate screwdriver head.	-
R Special adaptator flange for flexible shaft stretching	852-500-158-0
Dynamometer (0 to 25 daN., in range) (0 to 50 lbf., in range)	-
Circuit breaker safety clips	-

B. Prepare to Remove the Bucket Flexible Shafts

(1) Electrically isolate the engine and exhaust assembly services indicated in Table 401 by tripping the circuit breakers affecting engines the nacelle on which work is being carried out.

WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR

IS CONNECTED TO THE TWIN SECONDARY NOZZLE ON WHICH THE REMOVAL IS CARRIED OUT.

(2) Display a suitable placard on the engine starting panel, indicating that personnel are working on the engines and the twin secondary nozzle area.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINE NO.1			
ENG 1 BUCKET CONT UNIT SUP	14-215	1K1132	E12
ENG 1 REV THRUST CONT	3-213	1K331	D 1
ENGINE NO. 2			
ENG 2 BUCKET CONT UNIT SUP	13-215	2K1132	G14
ENG 2 REV THRUST CONT	1-213	2K331	B 5
ENGINE NO. 3			
ENG 3 BUCKET CONT UNIT SUP	13-216	3K1132	C 6
ENG 3 REV THRUST CONT	1-213	3K331	B 6
ENGINE NO. 4			
ENG 4 BUCKET CONT UNIT SUP	14-216	4K1132	C 6
ENG 4 REV THRUST CONT	3-213	4K331	D 2

Circuit Breakers
Table 401

(3) Remove the relevant access panels using a pneumatic impact wrench equipped with an appropriate screwdriver head.

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD.
USING MANUAL OR UNAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATIONS OF THE SCREWS. BEFORE CARRYING OUT ANY WORK, THE
R SECONDARY NOZZLE MUST BE LINED WITH RUBBER CARPETS. TO AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS OR SCRATCHES. A LIGHT PAIR
R OF SHOES MUST ALSO BE WORN WHEN STEPPING

ON THE NOZZLE.

(4) Move the buckets to the zero degree position and lock the pneumatic drive actuator in that position (Ref. 78-33-06, Adjustment/Test).

C. Removal of Flexible Shaft (1) (Ref. Fig. 401).

(1) Disconnect the flexible shaft from the bucket position transmitter (indicator). Remove the shim if fitted and the associated bolts.

(2) Disconnect the flexible shaft from the ballscrew gearbox. Remove the shim if fitted.

(3) Remove the flexible shaft from secondary nozzle and fit the flexible shaft clamp - support.

CAUTION: DURING TRANSPORT AND INSTALLATION/REMOVAL OR DURING STORAGE THE FLEXIBLE SHAFTS SHOULD BE KEPT IN A STRAIGHT POSITION. IF THIS CONDITION CAN NOT BE FOLLOWED DUE TO SOME OPERATIONAL REASON, IT WILL BE POSSIBLE TO ROLL THE FLEXIBLE SHAFTS MAKING SURE TO RES-
R PECT A MINIMUM BEND RADIUS OF 610 mm (24 inches). FAILURE TO DO SO COULD LEAD TO SYSTEM DAMAGE.

D. Removal of Flexible Shafts (2) (3) (4) (Ref. Fig. 401)

(1) Disconnect the flexible shafts from the ballscrew gearboxes. Remove the shims if fitted.

(2) Remove the flexible shafts from the secondary nozzle and fit the flexible shaft clamp-support.

CAUTION: DURING TRANSPORT AND INSTALLATION/REMOVAL OR DURING STORAGE THE FLEXIBLE SHAFTS SHOULD BE KEPT IN A STRAIGHT POSITION. IF THIS CONDITION CAN NOT BE FOLLOWED DUE TO SOME OPERATIONAL REASON IT WILL BE POSSIBLE TO ROLL THE FLEXIBLE SHAFTS MAKING SURE TO RESPECT A MINIMUM BEND RADIUS OF 610 mm (24 inches). FAILURE TO DO SO COULD LEAD TO SYSTEM DAMAGE.

E. Removal of Flexible Shafts (5) and (7) (Ref. Fig. 401)

(1) Disconnect the flexible shafts from the ballscrew gearboxes. Remove the shims if fitted.

(2) Disconnect the flexible shafts from the bucket pneumatic drive actuator. Remove the shims if fitted and

the associated bolts.

R (3) Remove the flexible shafts from the secondary nozzle
R and fit the flexible shaft clamp support.

CAUTION: DURING TRANSPORT AND INSTALLATION/REMOVAL OR DURING STORAGE THE FLEXIBLE SHAFTS SHOULD BE KEPT IN A STRAIGHT POSITION. IF THIS CONDITION CAN NOT BE FOLLOWED DUE TO SOME OPERATIONAL REASON IT WILL BE POSSIBLE TO ROLL THE FLEXIBLE SHAFTS MAKING SURE TO RESPECT A MINIMUM BEND RADIUS OF 610 mm (24 inches) FAILURE TO SO COULD LEAD TO SYSTEM DAMAGE.

R F. Removal of Flexible Shafts (6) and (8) (Ref. Fig. 401).

(1) Disconnect the flexible shafts from the ballscrew gearboxes. Remove the shims if fitted.

(2) Disconnect the flexible shafts from the bucket pneumatic drive actuator. Remove the shims if fitted and the associated bolts.

R (3) Remove the flexible shafts from secondary nozzle and
R fit the flexible shaft clamp support.

CAUTION: DURING TRANSPORT AND INSTALLATION/REMOVAL OR DURING STORAGE THE FLEXIBLE SHAFTS SHOULD BE KEPT IN A STRAIGHT POSITION. IF THIS CONDITION CAN NOT BE FOLLOWED DUE TO SOME OPERATIONAL REASON IT WILL BE POSSIBLE TO ROLL THE FLEXIBLE SHAFTS MAKING SURE TO RESPECT A MINIMUM BEND RADIUS OF 610 mm (24 inches) FAILURE TO SO COULD LEAD TO SYSTEM DAMAGE.

G. Prepare to Install the Bucket Flexible Shafts (Ref. Fig. 401, 402 and 403).

(1) Measure the difference in length (L) between the flexible shaft core and its outer casing (Ref. Fig. 401) The length variation must fall within the length limits given in Table 402.

INDEX*	IPC REF.	LENGTH (L) LIMITS
1	14-50	64,3 to 74 mm (2.53 to 2.91 in)
2	14-30	61 to 70,6 mm (2.40 to 2.78 in)

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INDEX*	IPC REF.	LENGTH (L) LIMITS
3	14-170	2.40 to 2.78 in (61 to 70.6 mm)
4	14-40	2.40 to 2.78 in (61 to 70.6 mm)
5	14-10	2.49 to 2.87 in (63.2 to 73 mm)
6	14-150	2.42 to 2.80 in (61.5 to 71.1 mm)
7	14-20	2.63 to 3.01 in (66.8 to 76.4 mm)
8	14-160	2.68 to 3.06 in (68 to 77.7 mm)

Bucket Flexible Shafts - Length Limits
Table 402

*(Ref. Fig. 401)

(2) If the difference in length is not within the above limits, (the flexible casing is liable to experience shrinkage during storage), perform the following:

(a) Clamp the flexible shaft outer casing end (with the larger diameter collar) in a vice suitably fitted with soft jaws.

<u>CAUTION:</u> APPLY ONLY THE MINIMUM PRESSURE NECESSARY TO MAINTAIN THE FLEXIBLE CASE. EXCESSIVE CLAMPING PRESSURE COULD LEAD TO DETERIORATION OF THE FLEXIBLE CASING.

(b) Equip the opposite flexible casing collar with the special adaptor flange for stretching and connect the dynamometer.

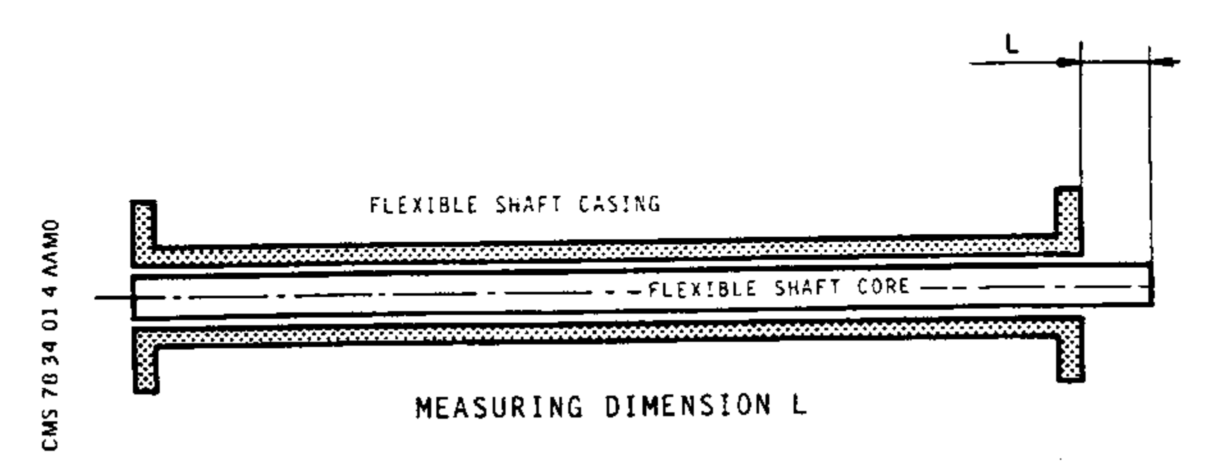
(c) Stretch the flexible casing by applying a pulling
R load of 30 to 40 lb (13.6 to 18.1 kg).

(d) Measure the difference in length (L) between the flexible shaft core and its outer casing (Ref. Fig. 401). If the length (L) does not fall within the limits given in Table 402, repeat operation (c).

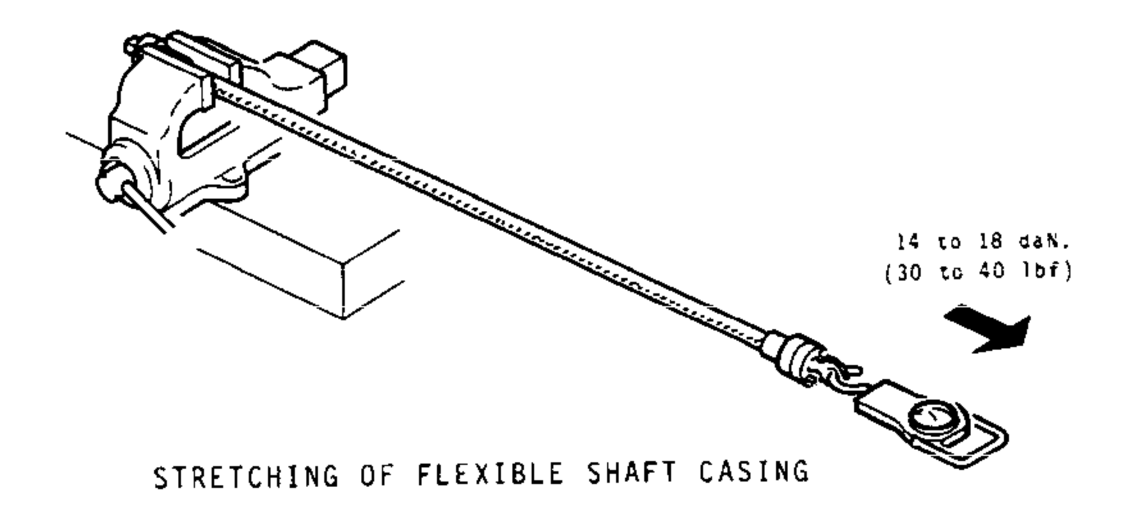
(3) Check the correct position of the protection springs on the flexible casing (when applicable) by measuring the length (R) between the spring and the flexible casing collar (Ref. Fig. 402). Compare the length (R) with the figures given in Table 403 and if necessary, reposition the protection springs on the flexible casing.

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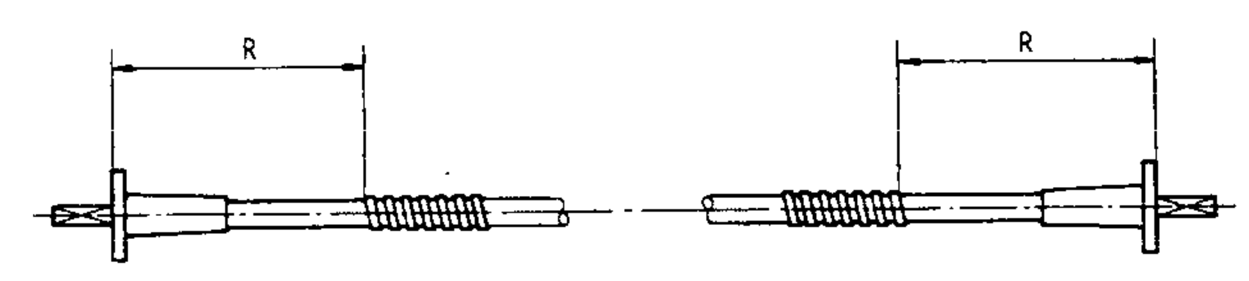
BUCKET PNEUMATIC DRIVE ACTUATOR
8
6
7
5
3
4
2
2
BUCKET BALLSCREW GEARBOX
BUCKET POSITION TRANSMITTER (INDICATOR)
1



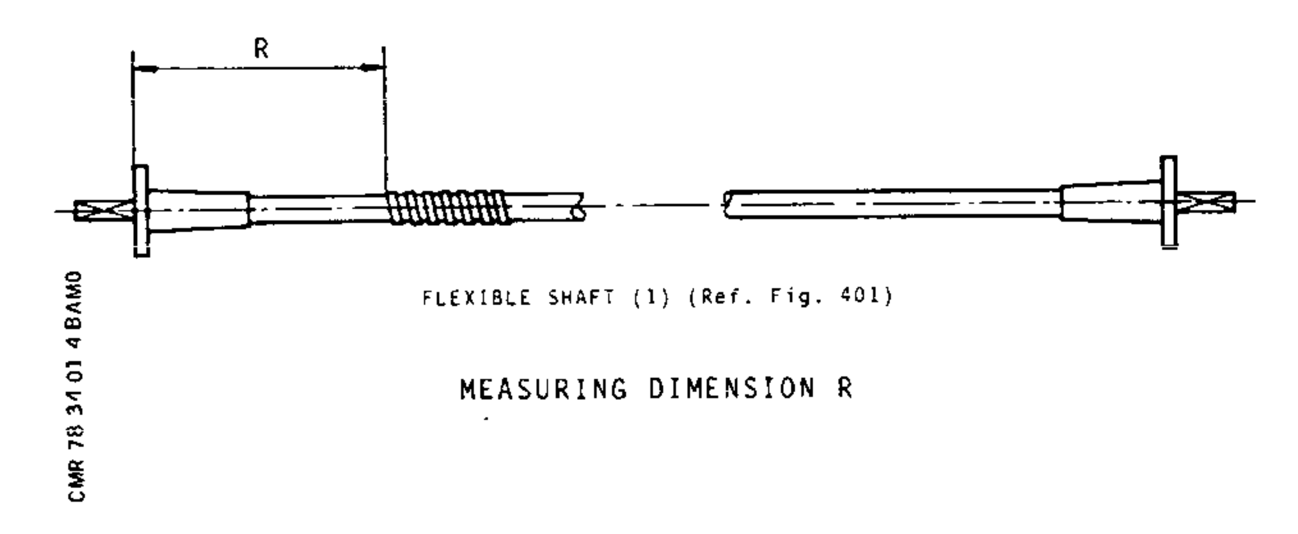
Removal/Installation of Bucket Flexible Shafts
Figure 401



STRETCHING OF FLEXIBLE SHAFT CASING



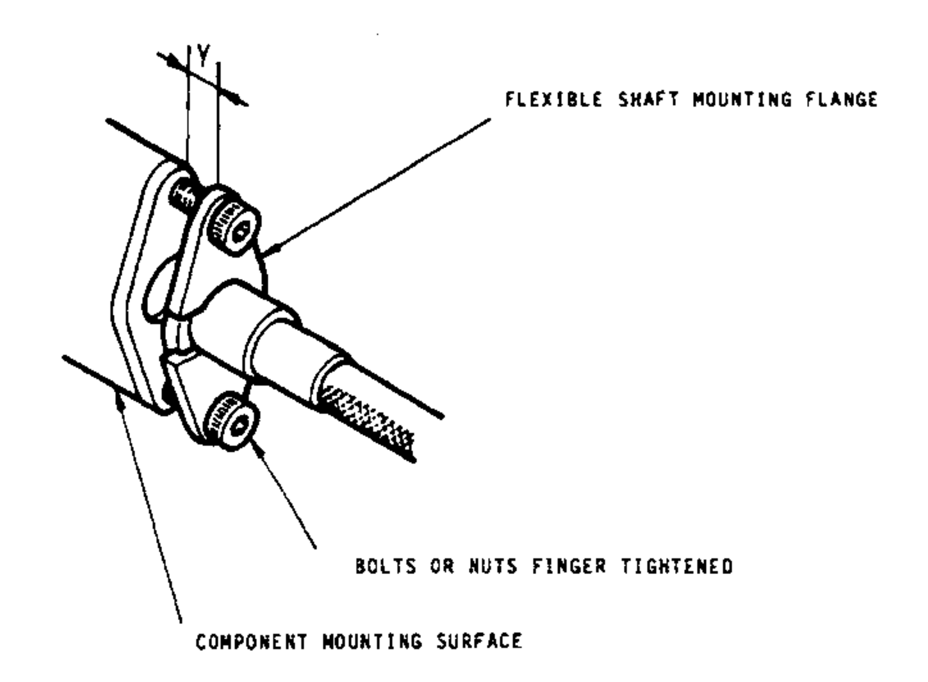
FLEXIBLE SHAFTS (2) (3) (4) (Ref. Fig. 401)



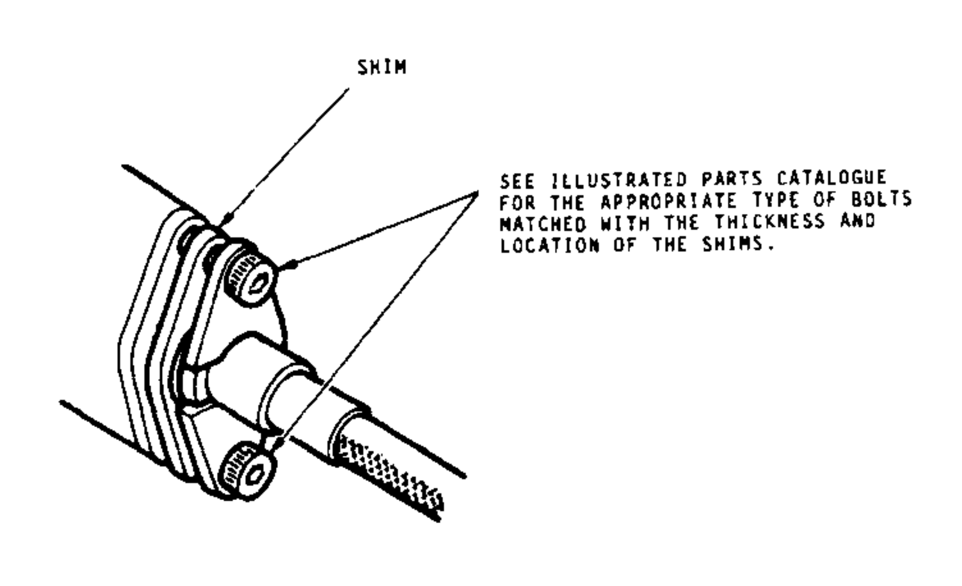
FLEXIBLE SHAFT (1) (Ref. Fig. 401)

MEASURING DIMENSION R

Prepare to Install Bucket Flexible Shafts
Figure 402



MEASURING THE DISTANCE Y



INSTALLING THE SHIM

CMS 78 34 01 4 CAMO

R Installation of Bucket Flexible Shafts
Figure 403

INDEX	IRC REF.	LENGTH (R)
1	14-50	335 mm (13.20 in)
2	14-30	260 mm (10.24 in)
3	14-170	260 mm (10-24 in)
4	14-40	260 mm (10.24 in)
5	14-10	NOT APPLICABLE
6	14-150	NOT APPLICABLE
7	14-20	NOT APPLICABLE
8	14-160	NOT APPLICABLE

NOTE: The length (R) is an average value and can be modified when fitting the flexible shafts in the secondary nozzle.

- Table 403 -

H. Installation of Flexible Shaft (1) (Ref. Fig. 401).

CAUTION: DURING INSTALLATION OF THE FLEXIBLE SHAFT IN THE STRUCTURE AND PENDING ITS ATTACHMENT TO THE TRANSMITTER OR TO THE BALLSCREW GEARBOX, FIT A CLAMP-SUPPORT AT EACH SHAFT END TO PREVENT THE CORE FROM SLIPPING OUT OF THE CASING.

R (1) Smear all pins and screws with lubricant S (Ref. 70-00-01).

(2) Ensure that the closed flange provided for the flexible shaft attachment is located at the larger collar end of the casing.

(3) Insert the core hexagonal drive end in the Bucket Ballscrew gearbox.

(4) Secure the flexible shaft flange to the bucket ballscrew gearbox and torque the fitting nuts to 0.30 daN.m (25 lbf in).

(5) Route the flexible shaft in the secondary nozzle.

(a) Avoid sharp bending of the flexible shaft, a minimum bend radius of 255 mm (10 inches) should be respected.

(b) Ensure that there is not contact between the fle-

xible shaft casing and the secondary nozzle structure.

(c) Check that the flexible shaft casing is correctly centered in the guide tubes.

(d) Check the correct position of the protection spring on the flexible shaft casing in relation with the guide tubes.

(6) Insert the core hexagonal drive end in the Bucket position transmitter (Indicator) and tighten the two attachments bolts finger tight.

NOTE: It may be necessary to rotate the core hexagonal drive end by plus or minus 30 degrees, using the appropriate wrench.

(7) Recheck the routing of the flexible shaft in the secondary nozzle. If necessary remove the two finger tightened bolts and reroute the flexible shaft.

(8) With the flexible shaft in the correct position and the two attachment bolts finger tightened, measure the distance Y between the flexible shaft mounting flange and the bucket position indicator (transmitter) mounting surface (Ref. Fig. 403).

(a) If the distance Y is less than 3 mm (0.12 in) no shim is required.

(b) If the distance Y is comprised between 3 and 5 mm (0.12 and 0.20 in) install a 4 mm (0.16 in) thick shim.

(c) If the distance Y is comprised between 5 and 7 mm (0.20 and 0.28 in) install a 6 mm (0.24 in) thick shim.

(9) If necessary, install the appropriate shim matched with the appropriate bolts and torque to 0.30 daN.m (25 lbf in).

CAUTION: USE THE APPROPRIATE BOLTS RELEVANT WITH THE THICKNESS OF THE SHIM. (SEE THE ILLUSTRATED PARTS CATALOGUE).

(10) Check the routing of the flexible shaft in the secondary nozzle as described in operation (5).

NOTE: With-dash 8 serie 1 standard-bucket ballscrew

gearboxes, installation of shims between the flexible shaft mounting flange and the bucket ballscrew gearbox mounting surface is possible. The procedure for the installation of the flexible shaft described above should be followed with the shim being fitted at the ballscrew gearbox/flexible shaft liaison instead of the flexible shaft/bucket position indicator (trans mitter) liaison.

CAUTION: SHIMS MUST BE FITTED ONLY AT ONE END OF THE FLEXIBLE SHAFT. SHIMMING AT BOTH ENDS OF THE FLEXIBLE SHAFT IS PROHIBITED AND COULD LEAD TO SYSTEM DAMAGE.

I. Installation of Flexible Shafts (2) (3) and (4). (Ref. Fig. 401).

CAUTION: DURING INSTALLATION OF THE FLEXIBLE SHAFTS IN THE STRUCTURE AND PENDING THEIR ATTACHMENT TO THE BUCKETS BALLSCREW GEARBOXES, FIT A CLAMP-SUPPORT AT EACH SHAFT END TO PREVENT THE CORE FROM SLIPPING OUT THE CASING.

(1) Ensure that the closed flange provided for the flexible shaft attachment is located at the larger collar end of the casing.

(2) Insert the flexible shaft in the guide tube by pulling it from bottom to the top of the secondary nozzle.

CAUTION: INTRODUCTION OF THE FLEXIBLE SHAFTS IN THE GUIDE TUBE IS TO BE CARRIED OUT BY PULLING THE SHAFT CASING, USING THE APPROPRIATE TOOL.

R (3) Smear all pins and screws with lubricant S (Ref. 70-00-01).

(4) Insert the core hexagonal drive end in one of the bucket ballscrew gearbox.

(5) Secure the flexible shaft flange to the bucket ballscrew gearbox and torque the attachment nuts to 0.30 daN.m (25 lbf in).

(6) Route the flexible shaft in the secondary nozzle:

(a) Avoid sharp bending of the flexible shaft; a minimum bend radius of 255 mm (10 inches) should be respected.

(b) Ensure that there is no contact between the flexible shaft casing and the secondary nozzle structure.

(c) Check that the flexible shaft casing is correctly centered in the guide tube.

(d) Check the correct position of the protection springs on the flexible shaft casing in relation with the guide tubes.

(7) Insert the core hexagonal drive end in the other ballscrew gearbox and tighten the two attachment nuts finger tight.

NOTE: It may be necessary to rotate the core hexagonal drive end by plus or minus 30 degrees, using the appropriate wrench.

(8) Recheck the routing of the flexible shaft in the secondary nozzle. If necessary remove the two finger tightened nuts and reroute the flexible shaft.

(9) With the flexible shaft in the correct position and the two attachment nuts finger tightened, measure the distance Y between the flexible shaft mounting flange and the bucket ballscrew gearbox mounting surface (Ref. Fig. 403).

(a) If the distance Y is less than 3 mm (012 in) no shim is required.

(b) If the distance Y is comprised between 3 and 5 mm (0.12 and 0.20 in), install a 4 mm (0.16 in) thick shim.

(c) If the distance Y is comprised between 5 and 7 mm (0.20 and 0.28 in), install a 6 mm (0.24 in) thick shim.

(10) If necessary install the appropriate shim and torque to 0.30 daN.m (25 lbf in).

NOTE: Shimming is only possible with-dash 8 serie 1 standard-bucket ballscrew gearboxes.

CAUTION: SHIMS MUST BE FITTED ONLY AT ONE END OF THE FLEXIBLE SHAFT. SHIMMING AT BOTH ENDS OF THE FLEXIBLE SHAFTS IS PROHIBITED AND COULD LEAD TO SYSTEM DAMAGE.

(11) Check the routing of the flexible shaft in the secondary nozzle as described in operation (6).

J. Installation of Flexible Shafts (5) (6) (7) and (8). (Ref. Fig. 401)

CAUTION: DURING INSTALLATION OF THE FLEXIBLE SHAFTS IN THE STRUCTURE AND PENDING THEIR ATTACHMENT TO THE BUCKETS PNEUMATIC DRIVE ACTUATOR OR TO THE BUCKETS BALLSCREW GEARBOXES, FIT A CLAMP-SUPPORT AT EACH SHAFT END TO PREVENT THE CORE FROM SLIPPING OUT OF THE CASING.

(1) Ensure that the closed flange provided for the flexible shaft attachment is located at the larger collar end of the casing.

(2) Insert the flexible shafts (5) and (6) in the guide tube by pulling them from the bucket pneumatic drive actuator towards the bucket ballscrew gearbox.

CAUTION: INTRODUCTION OF THE FLEXIBLE SHAFTS IN THE GUIDE TUBES IS TO BE CARRIED OUT BY PULLING THE SHAFT CASING, USING THE APPROPRIATE TOOL

R (3) Smear all pins and screws with lubricant S (Ref. 70.00.01).

(4) Insert the core hexagonal drive end in the bucket ballscrew gearbox.

(5) Secure the flexible shaft flange to the bucket ballscrew gearbox and torque the attachment nuts to 0.30 daN.m (25 lbf in).

(6) Route the flexible shaft in the secondary nozzle.

(a) Avoid sharp bending of the flexible shaft. A minimum bend radius of 300 mm (12 inches) should be respected.

(b) Ensure that there is no contact between the flexible shaft casing and the secondary nozzle structure.

(c) Check that the flexible shaft casing is correctly centered in the guide tube.

(7) Insert the core hexagonal drive end in the bucket pneumatic drive actuator and tighten the two attachment bolts finger tight.

NOTE: It may be necessary to rotate the core hexagonal drive end by plus or minus 30 degrees, using the appropriate wrench.

(8) Recheck the routing of the flexible shaft in the secondary nozzle. If necessary remove the two finger tightened bolts and reroute the flexible shaft.

(9) With the flexible shaft in the correct position and the two attachment bolts finger tightened, measure the distance Y between the flexible shaft mounting flange and the bucket pneumatic drive actuator mounting surface (Ref. Fig. 403).

(a) If the distance Y is less than 3 mm (0.12 in) no shim is required.

(b) If the distance Y is comprised between 3 and 5 mm (0.12 and 0.20 in) install a 4 mm (0.16 in) thick shim.

(c) If the distance Y is comprised between 5 and 7 mm (0.20 and 0.28 in) install a 6 mm (0.24 in) thick shim.

(10) If necessary install the appropriate shim matched with the appropriate bolts and torque to 0.30 daN.m (25 lbf in).

CAUTION: USE THE APPROPRIATE BOLTS RELEVANT WITH THE THICKNESS OF THE SHIM (SEE ILLUSTRATED PARTS CATALOGUE).

(11) Check the routing of the flexible shaft in the secondary nozzle as described in step (6).

NOTE: With-dash 8 serie 1 standard-bucket ballscrew gearboxes, installation of shims between the flexible shaft mounting flange and the bucket ballscrew gearbox mounting surface is possible. The procedure for the installation of the flexible shaft described above should be followed with the shim being fitted at the bucket ballscrew gearbox/flexible shaft liaison instead of the flexible shaft/bucket pneumatic drive actuator liaison.

CAUTION: SHIMS MUST BE FITTED ONLY AT ONE END OF THE FLEXIBLE SHAFT. SHIMMING AT BOTH ENDS OF THE FLEXIBLE SHAFT IS PROHIBITED AND COULD LEAD TO SYSTEM DAMAGE.

K. Operational Test

(1) Carry out the bucket control operational test as detailed in Chapter 78-00-00, Adjustment/Test, Page 501, paragraph 2. A - B - E (operations (1) and (2)).

NOTE: Before carrying out this test, unlock the pneumatic drive actuator (Ref. 78-33-06, Adjustment/Test) and reset the circuit breakers (Ref. Table 401).

L. Final Installation

R (1) Disconnect the compressed air supply hose from the ground
R test connector.

R (2) Install the pipe closure nut on the ground test connector;
R torque to 3,5 daN.m (25.81 lb.ft) and safety with lockwire
R (Ref. 20-21-13).

R CAUTION: FAILURE TO CORRECTLY REPLACE AND SECURE THE PIPE
R CLOSURE NUT COULD RESULT IN HOT AIR LEAKAGE WITH
R CONSEQUENT DAMAGE TO ADJACENT WIRING LOOMS AND
R COMPONENTS.

R (3) Install the relevant access panels. Torque the fitting screws to 0,60 daN.m (53 lbf.in.) using a pneumatic vibration screwdriver pre-adjusted at the required torquing value and equipped with an appropriate screwdriver head.

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER
R HEAD.
USING MANUAL OR INAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

BUCKET POSITION TRANSMITTER (INDICATOR) - REMOVAL/INSTALLATION

1. General

Removal and installation of bucket position transmitter (indicator) shall be carried out as required for maintenance of this accessory or to facilitate access to panels or other components of its compartment.

CAUTION: REMOVAL AND INSTALLATION OF THE BUCKET POSITION TRANSMITTER (INDICATOR) MUST BE CARRIED OUT WITH
RB THE SYSTEM LOCKED IN THE ZERO DEGREE POSITION,
RB HARD AGAINST THE BALLSCREW GEARBOX STOPS.

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2. Removal/Installation of Bucket Position Transmitter (Indicator)

A. Equipment and Materials

DESCRIPTION	PART NO.
Extension	9970-515-296
Torque wrench 0 to 265.5 lbf in (0 to 3 mdaN range)	-
Pneumatic vibration screw driver (pre-adjusted at 53 lbf in 0.60 mdaN) and the appropriate screwdriver head.	-
Pneumatic impact wrench (unscrewing mode) ARO 8530 Pc1 and the appropriate screwdriver head	-
Circuit breaker safety clips	-

B. Prepare to Remove Bucket Position Transmitter (Indicator) (Ref. Fig. 401)

(1) Electrically isolate the engine and exhaust assembly services indicated in Table 401 by tripping the circuit breakers affecting engines in the nacelle upon which work is being carried out. Fit circuit breaker safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENGINE No.1			
BUCKET CONT UNIT SUP	14-215	1K1132	E12
REV THRUST CONT	3-213	1K331	D 1
PP MGT LTS SUP	5-213	1E461	D 1
WIND DOWN CONT SUP 1	5-213	1K1101	B 1

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
WIND DOWN CONT SUP 2	1-213	1K1108	C 7
ENGINE No.2			
BUCKET CONT UNIT SUP	13-215	2K1132	G14
REV THRUST CONT	1-213	2K331	B 5
PP MGT LTS SUP	1-213	2E461	E 3
WIND DOWN CONT SUP 1	1-213	2K1101	F 4
WIND DOWN CONT SUP 2	5-213	2K1108	C 1
ENGINE No.3			
BUCKET CONT UNIT SUP	13-216	3K1132	C 6
REV THRUST CONT	1-213	3K331	B 6
PP MGT LTS SUP	1-213	3E461	E 4
WIND DOWN CONT SUP 1	1-213	3K1101	F 5
WIND DOWN CONT SUP 2	5-213	3K1108	C 2
ENGINE No.4			
BUCKET CONT UNIT SUP	14-216	4K1132	C 6
REV THRUST CONT	3-213	4K331	D 2
PP MGT LTS SUP	5-213	4E461	D 2
WIND DOWN CONT SUP 1	5-213	4K1101	B 2
WIND DOWN CONT SUP 2	1-213	4K1108	C 8

Circuit Breakers
Table 401

WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE ON WHICH THE REMOVAL IS CARRIED OUT.

(2) Remove the access panel to the bucket position transmitter (indicator) which is to be removed, using a pneumatic impact wrench equipped with an appropriate screwdriver head (Ref. Fig. 401).

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD. USING MANUAL OR UNAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

(3) Inspect the condition of the seal on the inner side of the access panel. If the seal is found defective proceed to its replacement (Ref. 78.13.01.Page 801).

(4) Place the buckets in the zero degree position and manually lock the pneumatic drive actuator (Ref. 78-33-06, Adjustment/Test).

C. Removal of Bucket Position Transmitter (Indicator) (Ref. Fig. 402)

R B NOTE : When removing/Installing the "Bucket Position
R B Transmitter (Indicator) P.I.D.U" make an entry in
R B the Aircraft Technical Report (Sector Defect Log)
R B that a secondary nozzle ASOV check must be carried
R B out on departure from that station/base.

(1) Unlock and disconnect the three electrical connectors.

(2) Remove attaching bolts from flanged end of flexible shaft assembly and disconnect the shaft assembly from the position transmitter. Remove the shim if fitted.

(3) Remove the three attachment bolts and washers securing each spherical bearing mounting assembly to the secondary nozzle structure.

(4) Remove the two spherical bearing mounting assemblies.

(5) Remove the bucket position transmitter (indicator).

D. Prepare to Install Bucket Position Transmitter (Indicator) (Ref. Fig. 403).

(1) Make sure the bucket position transmitter is in the zero degree position.

(2) If it is not in zero degree position, proceed as follows :

(a) Slide back the cover to the zero degree position indicator port.

(b) Observe the position of the feedback shaft and the translating nut through the port and proceed as follows to set the unit at the zero degree position:

ELECTRICAL CONNECTORS

A

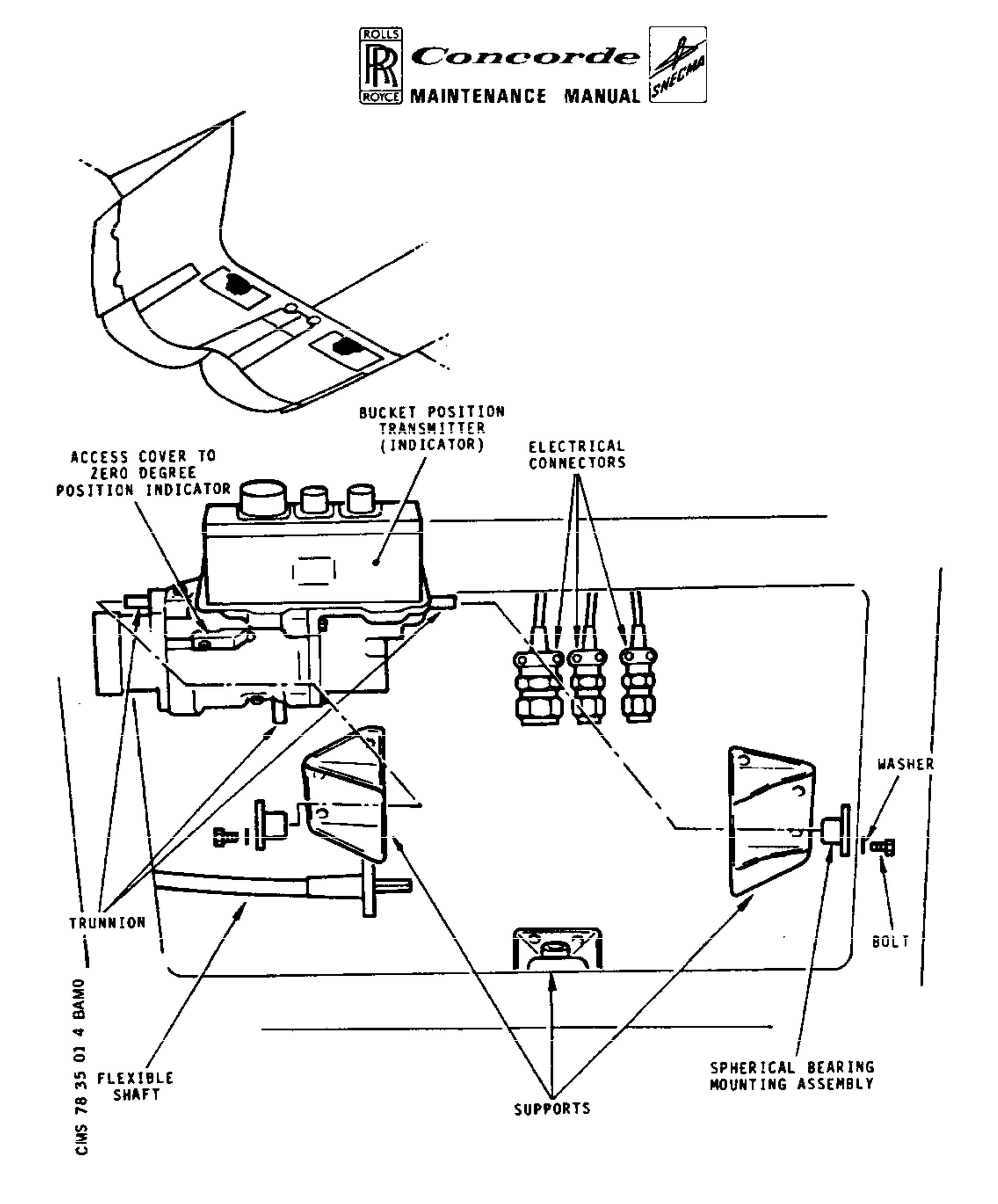
FLEXIBLE SHAFT

BUCKET POSITION TRANSMITTER (INDICATOR)

FORWARD

CMS 78 35 01 4 AAM0

Preparation for Removal of Bucket Position
Transmitter (Indicator)
Figure 401



Removal/Installation of Bucket Position
Transmitter (Indicator)
Figure 402

(i) If the semi-circular notch of the nut is visible: turn clockwise shaft A. On approach, very slowly rotate input shaft A until the semi-circular notch of the nut lines up exactly both axially and rotationally with the feedback shaft blind hole.

(ii) If the nut appears on the left, turn counterclockwise until the nut passes on the other side of the blind hole then proceed as indicated in (i) above.

(iii) If the nut is not visible, first turn 10 turns clockwise. If the nut does not appear, turn shaft A counterclockwise until it appears and continue adjustment as indicated in (i) above.

CAUTION: IF DURING COUNTERCLOCKWISE ROTATION THE TRANSLATING NUT PASSES THE PORT AND CONTACTS THE STOW STOP, DO NOT APPLY MORE THAN 0,05 daN.m (5 lb.in) TORQUE TO INPUT SHAFT A WHEN THE UNIT IS AGAINST THE STOP, OR DAMAGE MAY RESULT. ONCE THE TRANSMITTER HAS BEEN POSITIONED AT ZERO DEGREE, THE OUTPUT SHAFT MUST NOT BE MOVED SO LONG AS THE TRANSMITTER HAS NOT BEEN INSTALLED IN THE TWIN SECONDARY NOZZLE AND CONNECTED WITH THE RELEVANT FLEXIBLE SHAFT.

(3) Smear all pins and bolts with lubricant S (Ref. 70-00-01).

E. Installation of Bucket Position Transmitter (Indicator) (Ref. Fig. 402)

(1) Install the position transmitter by introducing in the remaining spherical bearing the corresponding trunnion.

(2) While holding the transmitter, position the other two spherical bearings mounting assemblies.

(3) Install the attachment bolts complete with washers. Torque tighten the bolts to 0,8 daN.m (70 lbf.in).

(4) Reconnect the flexible shaft to the position transmitter and torque tighten the attaching bolts between 0,2 to 0,4 daN.m (18 to 25 lbf.in). Reinstall the shim if removed in operation (2) Paragraph C.

ZERO DEGREE
POSITION INDICATOR
PORT

SHAFT A

SEMI-CIRCULAR
NOTCH

BLIND
HOLE

FEEDBACK SHAFT

TRANSLATING
NUT

CMS 78 35 01 4 CAMO

Zero Degree Positioning of the Bucket Position
Transmitter (Indicator)
Figure 403

(5) Reconnect the three electrical connectors and wire-lock the plugs.

F. Final Installation.

(1) Remove the manual lockout from the bucket pneumatic drive actuator and place it in the "UNLOCKED" position (Ref. 78-33-06, Adjustment/Test).

(2) Remove the safety clips and reset all the circuit breakers.

(3) Carry out an operational test (Ref. 78-00-00, Adjustment/Test, page 501, paragraph 2. A-B-C and D).

(4) Install the access panels to the bucket pneumatic, drive actuator and to the bucket position transmitter (Indicator). Torque the fitting screws to 0.60 daN.m (53 lbf.in) using a pneumatic vibration screw driver pre-adjusted at the required torquing value and equipped with an appropriate screwdriver head.

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD. USING MANUAL OR UNAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

BUCKET POSITION TRANSMITTER (INDICATOR) - INSPECTION/CHECK

1. General

This chapter defines the inspection to be carried out and the acceptance criteria related to the bucket position transmitter (indicator) mounting trunnions. This inspection can only be carried out once the unit has been removed from the secondary nozzle.

2. Inspection of the Bucket Position Transmitter (Indicator) Mounting Trunnions.

A. Removal of the Bucket Position Transmitter (Indicator) (Refer to 78-35-01, REMOVAL/INSTALLATION).

B. Inspection of the Bucket Position Transmitter (Indicator) (Ref. Fig. 601).

(1) Clean the unit mounting trunnions, using a lint-free rag.

(2) Check the mounting trunnions for condition.

(3) Using a slide gage, measure and record the diameter of each mounting trunnion. A maximum wear of 1,5 mm (0.059 in) on any mounting trunnion is acceptable.

NOTE: The nominal diameter of each mounting trunnion is 7,9 mm (0.311 in).

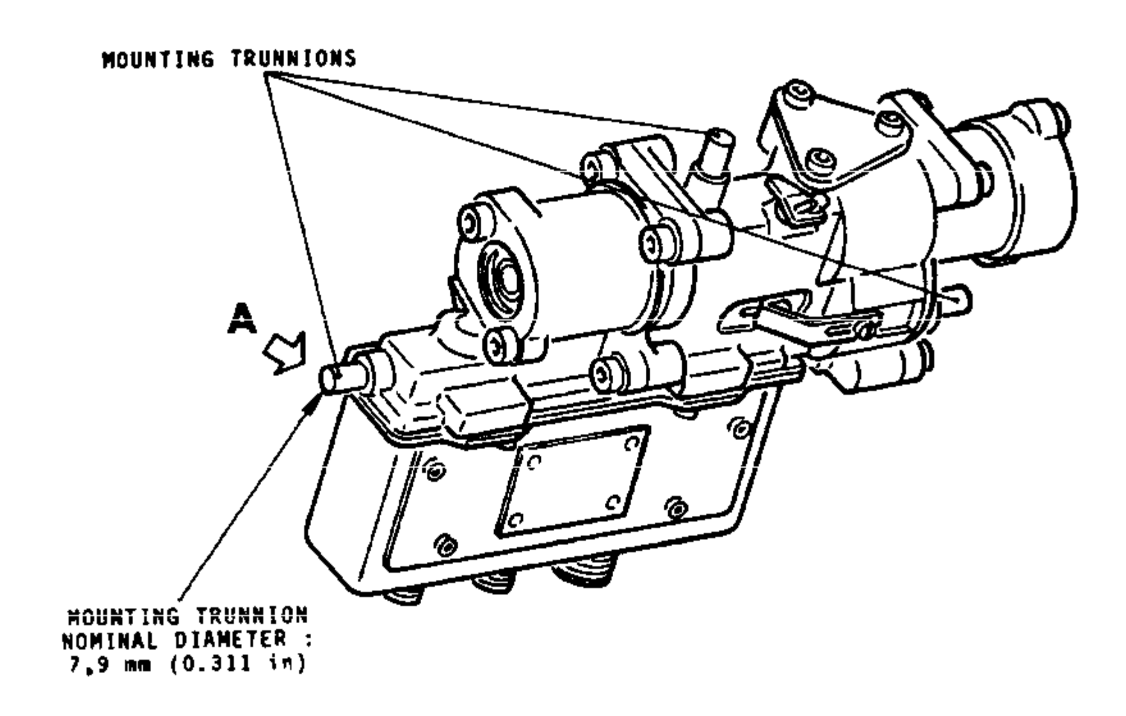
C. Acceptance Criteria (Ref. Fig. 601)

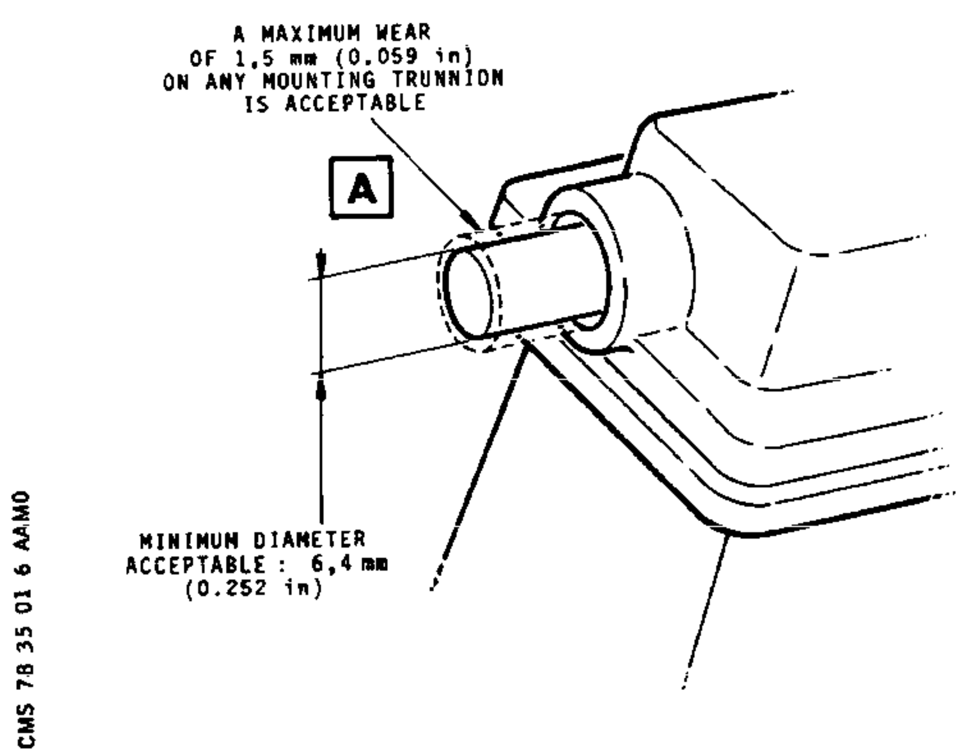
(1) If any of the mounting trunnion diameter is less than 6,4 mm (0.252 in), the bucket position transmitter (indicator) must be changed.

D. Installation of the Bucket Position Transmitter (Indicator)

(1) Re-install the same unit (if the wear on trunnions is within limits) or else use a new one, in accordance with the instructions given in 78-35-01, REMOVAL/INSTALLATION.

Acceptance Criteria





CMS 78 35 01 6 AAM0

Inspection of Bucket Position Transmitter
(Indicator) Mounting Trunnions!
Figure 601

NOZZLE AND THRUST REVERSER CONTROLLER (BUCKET CONTROL UNIT) ADJUSTMENT/TEST

1. General

This chapter gives all the information required for the use of the NTRC signal measurement box.

The NTRC signal measurement box is used for tests after Removal/Installation of the NTRC (BCU) (Ref. 78-31-85) and during Trouble Shooting procedures of the Bucket Control System (Ref. 71-00-51).

The NTRC's are located in the flight compartment equipment racks, on shelf 10-215 for engines 1 and 2, and on shelf 1-216 for engines 3 and 4.

2. NTRC Signals Measurement

A. Equipment

		DESCRIPTION	PART NO.	BA STORES CODE
R	B	NTRC Signal measurement Box	293094-1	GEES 0880

B. Connect the NTRC signal measurement box to the NTRC (Ref. Fig. 501)

(1) Ensure that the aircraft external power supplies are connected.

(2) Before connecting the NTRC signal measurement box to the NTRC, ensure that DC and AC selectors are in OFF position.

(3) Check that buckets are at 21 deg. angular positions by measuring bucket jack stroke. Stroke must be between 76 and 96 mm (2.99 and 3.78 in.).

(4) Position the throttle lever fully rearward in its gate with thrust reverse lever fully down.

(5) Ensure that the following system circuit breakers listed in Table 501 are set.

DC VOLTMETER

TERMINAL J2

DC AND AC
SIGNAL SELECTORS

TERMINAL J1

NTRC SIGNAL
MEASUREMENT
BOX

AC VOLTMETER

CMS 78 36 01 5 AFMO

NTRC Signal Measurement Box Connected to NTRC
Figure 501

B

R

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
NASU 1 SUP	14-216	K1136	A7
NASU 2 SUP	13-215	K1137	B13
ADC 1 115V SUP	2-213	1F73	F3
ADC 1 28V SUP	1-213	1F74	P12
ADC 2 115V SUP	13-216	2F73	F15
ADC 2 28V SUP	5-213	2F74	F12
ENGINE No. 1			
BUCKET CONT UNIT SUP	14-215	1K1132	E12
REV THRUST ASOV CONT	3-213	1K334	G3
REV THRUST CONT	3-213	1K331	D1
ENGINE No. 2			
BUCKET CONT UNIT SUP	13-215	2K1132	G14
REV THRUST ASOV CONT	1-213	2K334	D7
REV THRUST CONT	1-213	2K331	B5
ENGINE No. 3			
BUCKET CONT UNIT SUP	13-216	3K1132	C6
REV THRUST ASOV CONT	1-213	3K334	D8
REV THRUST CONT	1-213	3K331	B6
ENGINE No. 4			
BUCKET CONT UNIT SUP	14-216	4K1132	C6
REV THRUST ASOV CONT	3-213	4K334	G4
REV THRUST CONT	3-213	4K331	D2

Circuit Breakers
Table 501

(6) Connect the NTRC signal measurement box to the NTRC.

C. NTRC Signals Measurement

NOTE: When measuring DC and AC signals, use either the VDC or E4 press buttons to select the appropriate scale of the voltmeter indicators.

(1) Check DC signals by actuating the relevant selector.

(a) S1 position: voltage should be 5V approx.

(b) E2-E3 position: voltage should be between 2.28 and 2.77 volt.

(c) TMMV position: measure the torque motor monitoring voltage

B NOTE: Set ADC power supply CB's and switch on
B both ADC 1 and ADC 2.

(i) With ADC TEST Switch in "NORM" position, TMMV voltage should be between 0.22 and 0.52 volts.

(ii) With ADC TEST switch in "2" position, TMMV voltage should be between - 0.49 and - 0.6

NOTE: Depress "TMMV 0-3" push button on the NTRC signal measurement box.

(iii) Return ADC TEST switch to "NORM" position and pull the thrust reverse lever to the baulk position - TMMV voltage should be between 1.12 to 1.62 volts.

(iv) Position the throttle lever back to "Idle/Forward thrust" position.

(d) S3 position: voltage should be 0 volt. Pull the thrust reverse lever to the baulk and check that S3 signal is 28 volts approx. Position the throttle lever back to "Idle/Forward thrust" position.

(e) ASOV position: voltage should be 0 volt. Position ADC TEST switch in "2" position and check that ASOV voltage is 28 volts approx. Return AD TEST switch to "NORM" position.

R (f) Reject any NTRC which has an AC component in the
R DC signal.

(2) Check AC signals by actuating the relevant selector.

(a) E1 position: voltage should be between 23 and 34.8 volts.

(b) E2 position: voltage should be between 6.6 and 7.4 volts.

(c) E3 position: voltage should be between 3.75 and 4.55 volts.

(d) E4 position: voltage should be between 17.5 and 23.5 volts.

(e) With an AVO connected to terminals J1 and J2 voltage should be USV i.e. A/C supply.

D. The following additional information is given in order to assist trouble shooting.

Signal

S1	=	Position command signal from Nozzle Angle Scheduling Unit (NASU)
S3	=	Thrust reverse command signal from reverse switch pack on pedestal
E2-E3	=	Feedback difference signal internally generated in Controller
TMMV	=	Torquemotor metering voltage generated by Controller to feed torque motor of pneumatic drive actuator
E1	=	Pneumatic drive actuator LVDT excitation signal generated by the Controller to excite the primary cost of the LVDT.
E2	=	Feed back signal from LVDT Secondary coil to Controller
E3	=	Feed back signal from LVDT Secondary coil to Controller

<u>NOTE:</u> E3 and E3 allow E2-E3 and E2+E3 to be generated inside the Controller.

E4	=	Output Signal to Secondary nozzle indicator. Signal determined from E2 and E3.
ASOV	=	27° s/w in Controller which energises ASOV locking relay and closes the ASOV in the pneumatic drive actuator.

E. Conclusion

(1) Position both AC and DC selectors to OFF.

(2) Disconnect the NTRC signal measurement box from the NTRC.

(3) Re-blank the NTRC J2 test connector.

B NOTE: Set ADC power supply CB's and switch on both
B ADC 1 and ADC 2.

CROSSFEED ISOLATION VALVE - DESCRIPTION AND OPERATION

1. General

The crossfeed isolation valve is located between left and right engine pairs on the aircraft. When selected open, the valve admits compressor bleed-air pressure from the higher bleed pressure engine to the lower bleed pressure engine for use in the thrust reverser actuation system.

2. Description (Ref. Fig. 001)

This valve is a normally closed, inline-poppet-type, solenoid-controlled, pneumatically-actuated shutoff valve capable of functioning with air flow in either direction. The valve consists of a solenoid valve assembly, position indicator switch assembly and two bolted bodies.

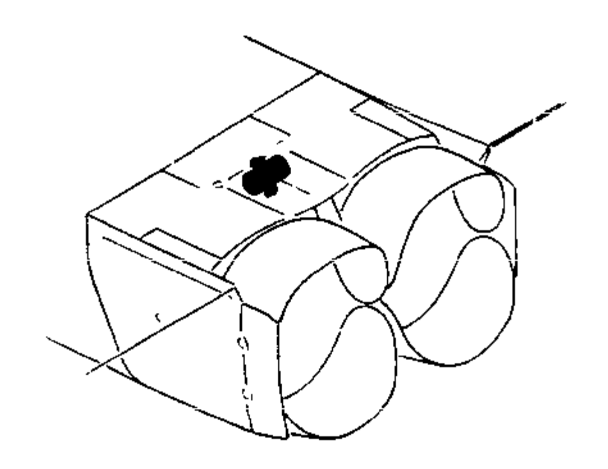
The solenoid valve assembly is mounted on top of the smaller body and consists essentially of a solenoid assembly and valve assembly. The solenoid assembly consists of an electromagnet assembly and armature. The valve assembly consists of two seats and a ball. The electromagnet assembly is provided with an electrical receptacle for aircraft electrical connection. When energized, the electromagnet assembly is capable of moving the armature which in turn moves the ball.

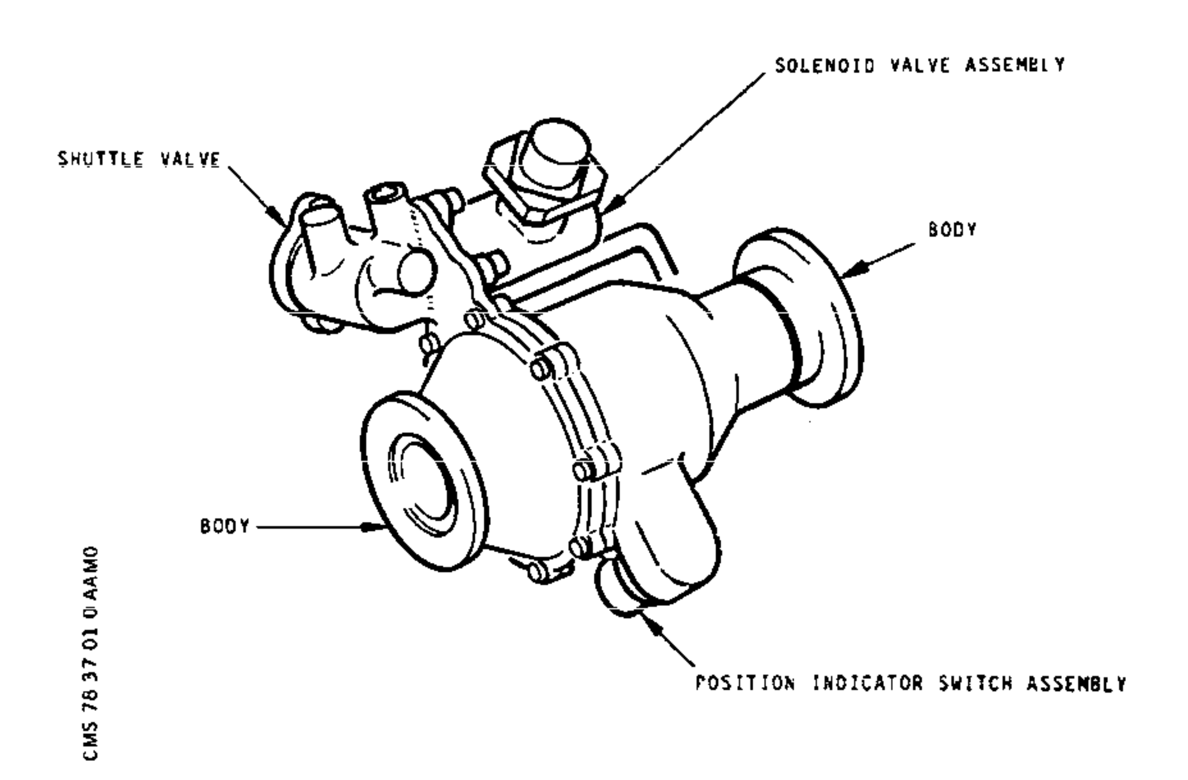
The position indicator switch assembly is mounted on the bottom of the larger body and consists of a micro switch and electrical receptacle for aircraft electrical connection. The micro switch is tripped or released by a lever acting on the switch actuator.

The two bolted bodies house a piston poppet, a free floating shuttle valve and a spring. In addition, the bodies provide mounting points for the solenoid valve assembly and position indicator switch assembly.

3. Operation (Ref. Fig. 002)

When airflow is directed to ports A and B, the shuttle valve will respond to the higher differential pressure. This pressure is directed to chamber C through the solenoid valve assembly. If the piston poppet is initially opened and air pressure from either port A or port B is flowing through the solenoid valve assembly to chamber C, then an equalizing force is created to balance pneumatic forces on the piston poppet. The spring load will move the piston poppet to the closed position. If the air pressure at port A is higher, and additional closing force is created to act on the poppet area minus the poppet seating area .





CMS 78 37 01 0 AAM0

Crossfeed Isolation Valve
Figure 001

AMBIENT VENT

SOLENOID VALVE ASSEMBLY
SHOWN DE-ENERGIZED

A
B
SOLENOID VALVE ASSEMBLY
WIRING DIAGRAM

PISTON POPPED
SPRING
SHUTTLE VALVE
PORT A
AIR IN
AIR IN
PORT B
BODY
CHAMBER C
POSITION INDICATOR SWITCH ASSEMBLY

B
NO
C
C
NC
A
POSITION INDICATOR SWITCH
ASSEMBLY WIRING DIAGRAM

Pre SB OL. 593-78-14052-37

CMS 78 37 01 0 DAMA

Crossfeed Isolation Valve Schematic
Diagram (Sheet 1 of 2)
Figure 002

R

AMBIENT VENT

SOLENOID VALVE ASSEMBLY
SHOWN DE-ENERGIZED

A
B
SOLENOID VALVE ASSEMBLY
WIRING DIAGRAM

B
NO
C
C
NC
A
POSITION INDICATOR SWITCH
ASSEMBLY WIRING DIAGRAM

PISTON POPPED

SPRING

SHUTTLE VALVE

PORT A

AIR IN

AIR IN

PORT B

BODY

CHAMBER C

ADJUSTING STOP

CMS 78 37 01 0 BAMB

Post SB OL. 593-78-14052-37

Crossfeed Isolation Valve Schematic
Diagram (Sheet 2 of 2)
Figure 002

If the piston poppet is initially closed by spring load and the higher air pressure is at port B, then an additional force is created to act upon the poppet seating area to hold the valve closed. When the solenoid valve assembly is energized, the actuator supply pressure is blocked. Chamber C is allowed to vent through the solenoid valve assembly.

If air pressure at port A is higher, then air pressure acting on the poppet seating area creates a force to open the piston poppet. If air pressure at port B is higher, then air pressure acting on the piston poppet area minus the poppet seating area creates a force to open the piston poppet. Once the piston poppet is opened, duct pressure acting on the poppet area holds the piston poppet open. The piston indicator switch assembly will close an electrical circuit when the piston poppet starts to open.

CROSSFEED ISOLATION VALVE - REMOVAL/INSTALLATION

1. General.

   This topic details the Removal/Installation of the crossfeed isolation valve.

2. Crossfeed Isolation Valve

   A. Equipment and Materials.

DESCRIPTION	PART NO.
Torque wrench (0 to 3 daN.m in range)	
Circuit breaker safety clips	
Pneumatic vibration screw-driver (pre-adjusted at 0,60 daN.m 53 lbf.in.) and the appropriate screwdriver head.	
Pneumatic impact wrench (unscrewing mode) ARO 8530 PC1 and the appropriate screwdriver head.	
R 3 bars (43 psig) air pressure source.	

   B. Prepare to Remove Crossfeed Isolation Valve.

      (1) Electrically isolate the engine and exhaust assembly services indicated in Table 401 by tripping the circuit breakers concerning engine in the nacelle upon which work is being carried out. Fit circuit breaker safety clips.

      WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE ON WHICH THE REMOVAL IS CARRIED OUT.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINES No. 1 and No. 2			
P.P. MGT LTS SUP	1-213	2E461	E 3

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINES No.3 and No.4			
P.P. MGT LTS SUP	1-213	3E461	E 4

Circuit Breakers
Table 401

(2) Remove the relevant access panel to the crossfeed isolation valve using a pneumatic impact wrench equipped with an appropriate screwdriver head.

CAUTION: USE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITIONS OF THE SCREWDRIVER HEAD.
USING MANUAL OR UNAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.
BEFORE CARRYING OUT ANY WORK, THE SECONDARY NOZZLE MUST BE LINED WITH RUBBER CARPETS TO AVOID DAMAGE RESULTING FROM ACCIDENTAL BLOWS OR SCRATCHES. A LIGHT PAIR OF SHOES MUST ALSO BE WORN WHEN STEPPING ON THE NOZZLE.

C. Remove Crossfeed Isolation Valve (Ref. Fig. 401)

(1) Unlock and disconnect the solenoid valve connector.

(2) Unlock and disconnect the position indicator connector.

(3) Remove the split pin, the nut and the screw.

(4) Slacken the clamps, make them slide over their respective elbows.

(5) Spread the elbows apart slightly so as to clear the crossfeed isolation valve. Remove the seals and save them if their visual appearance is satisfactory.

(6) Remove the crossfeed isolation valve so as to free it from the centering pin.

D. Prepare to Install Crossfeed Isolation Valve (Ref. Fig. 401)

SOLENOID VALVE CONNECTOR

SUPPORT BRACKET

CLAMP

ELBOW

CLAMP

POSITION INDICATOR CONNECTOR

CENTERING PIN

CMS 78 37 01 4 AAM0

SEAL

BOLT

SPLIT PIN

NUT

YOKE

R

Crossfeed Isolation Valve
Figure 401

(1) Unlock and withdraw the three bolts holding the isolation valve support bracket to the removed isolation valve.

(2) Remove and save the isolation valve support bracket.

(3) Refit and wire lock the three bolts. Torque tighten between 0,35 and 0,40 daN.m (31 and 35 lbf.in.).

(4) On the isolation valve to be fitted, unlock and withdraw the three bolts securing the isolation valve housing.

(5) Fit the isolation valve support bracket and secure it with three bolts.

NOTE: The isolation valve support bracket must be held between the bolt heads and the isolation valve housing.

E. Install Crossfeed Isolation Valve (Ref. Fig. 401)

(1) Position the crossfeed isolation valve spreading the elbows apart. Slide it horizontal on the centering pin.

CAUTION: DO NOT FORGET TO FIT SEALS ON THE ELBOWS.

(2) Install the clamps and moderately tighten the nuts.

(3) Position the yoke on the crossfeed isolation valve, attach it with the screw and nut and torque to 0,2 and 0,6 daN.m (17.7 and 53 lbf.in.).

(4) Reconnect the solenoid valve connector.

(5) Reconnect the position indicator connector.

F. Operational Test

(1) Remove the safety clips and reset all circuit breakers (Ref. Table 401).

(2) Position the 4 throttle levers fully rearward in their gates with thrust reverse levers fully down.

R (3) Cut and remove lockwire; unscrew and remove the pipe
R closure nut from the ground test connector.

R (4) Connect an air source to the ground test connector of the engine bay No. 1 or 4.

NOTE: The capacity of the compressed air generator will have to be such that the supply pressure measured upstream of the ground connector does not drop below 2,5 bars (36 psig) during the bucket full travel.

WARNING: AS SOON AS THE PRESSURE ACTS ON THE CONTROL SYSTEM, THE BUCKETS MIGHT TRAVEL IN THE AREA COMPRISED BETWEEN 0 AND 21 DEGREES. ENSURE THAT THE PERSONNEL OR EQUIPMENT ARE CLEAR OF THE AREA SURROUNDING THE BUCKETS.

R (5) Switch on "FLIGHT REVERSE ARM" and check that "OPEN" caption illuminates.

R (6) Pull the engine No. 2 or 3 reverse thrust lever to the intermediate baulk and observe buckets and indicators. Check that transit time does not exceed 3.5 seconds.

R (7) Position the reverse thrust lever down in forward baulk position.

G. Final Installation

R (1) Disconnect compressed air supply and reblank the ground
R test connector; torque the pipe closure nut to 3,5 daN.m
R (25.81 lb.ft) and lockwire (Ref. 20-21-13).

R CAUTION: FAILURE TO CORRECTLY REPLACE AND SECURE THE PIPE
R CLOSURE NUT COULD RESULT IN HOT AIR LEAKAGE WITH
R CONSEQUENT DAMAGE TO ADJACENT WIRING LOOMS AND
R COMPONENTS.

(2) Install the access panel to the crossfeed isolation valve. Torque the fitting screws to 0,60 daN.m (53 lbf.in.) using a pneumatic vibration screwdriver pre-adjusted at the required torquing value and equipped with an appropriate screwdriver head.

CAUTION: USE THE APPROPRIATE TOOLS AND PAY SPECIAL ATTENTION TO THE TYPE AND CONDITION OF THE SCREWDRIVER HEAD. USING MANUAL OR UNAPPROPRIATE TOOLS COULD ONLY LEAD TO THE DETERIORATION OF THE SCREWS.

END OF THIS SECTION

NEXT